REGISTER

OF

THE LEHIGH UNIVERSITY,

1887-1888.

TUITION FREE.

SOUTH BETHLEHEM, PA.:
1888.

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OF

THE LEHIGH UNIVERSITY,

SOUTH BETHLEHEM, PA.

1887-1888.

FOUNDED BY ASA PACKER.

TUITION FREE.

BETHLEHEM, PA.
THE COMENIUS PRESS.
1888.

TABULAR ALMANAC.

1887.

JULY.

S	M	T	W	T	F	S
...	...	...	...	...	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	...	...	...	...	...	...

AUGUST.

S	M	T	W	T	F	S
...	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	...	...	...
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SEPTEMBER.

S	M	T	W	T	F	S
...	...	...	...	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	...
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OCTOBER.

S	M	T	W	T	F	S
...	...	...	...	...	...	1
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9	10	11	12	13	14	15
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23	24	25	26	27	28	29
30	31	...	...	...	...	...

NOVEMBER.

S	M	T	W	T	F	S
...	...	1	2	3	4	5
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13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	...	...	...
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DECEMBER.

S	M	T	W	T	F	S
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11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
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1888.

JANUARY.

S	M	T	W	T	F	S
1	2	3	4	5	6	7
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15	16	17	18	19	20	21
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FEBRUARY.

S	M	T	W	T	F	S
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	...	...	...
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MARCH.

S	M	T	W	T	F	S
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11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
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APRIL.

S	M	T	W	T	F	S
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MAY.

S	M	T	W	T	F	S
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27	28	29	30	31	...	...
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JUNE.

S	M	T	W	T	F	S
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10	11	12	13	14	15	16
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JULY.

S	M	T	W	T	F	S
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AUGUST.

S	M	T	W	T	F	S
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12	13	14	15	16	17	18
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SEPTEMBER.

S	M	T	W	T	F	S
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OCTOBER.

S	M	T	W	T	F	S
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14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	...	...	...
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NOVEMBER.

S	M	T	W	T	F	S
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11	12	13	14	15	16	17
18	19	20	21	22	23	24
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DECEMBER.

S	M	T	W	T	F	S
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16	17	18	19	20	21	22
23	24	25	26	27	28	29
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1889.

JANUARY.

S	M	T	W	T	F	S
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13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	...	...
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FEBRUARY.

S	M	T	W	T	F	S
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17	18	19	20	21	22	23
24	25	26	27	28	...	...
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MARCH.

S	M	T	W	T	F	S
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10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	...	...	...	...	...	...

APRIL.

S	M	T	W	T	F	S
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MAY.

S	M	T	W	T	F	S
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	...
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JUNE.

S	M	T	W	T	F	S
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2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	...	...	...	...	...	...

CALENDAR.

1887-1888.

1887. Sept. 12, 13, 14,	Monday, Tuesday and Wednesday,	Examinations for Admission.
Sept. 14,	Wednesday,	First Term begins.
Oct. 13,	Thursday,	Founder's Day.
Nov. 24,	Thursday,	Thanksgiving Day.
Dec. 21,	Wednesday,	First Term ends.
1888. Jan. 10, 11,	Tuesday and Wednesday,	Examinations for Admission to Second Term.
Jan. 11,	Wednesday,	Second Term begins.
Jan. 21,	Saturday,	Junior Prize Orations due.
Feb. 15,	Wednesday,	Ash Wednesday.
Feb. 22,	Wednesday,	Washington's Birthday.
March 29,	Thursday,	Easter Holidays begin.
April 3,	Tuesday,	Easter Holidays end at 8¼ A.M.
May 26,	Monday,	University-Day Orations due.
May 30,	Wednesday,	Theses of Seniors due.
May 30,	Wednesday,	Senior Examinations begin
June 6,	Wednesday,	Annual Examinations begin.
June 9,	Saturday,	Senior Examinations end.
June 13, 14, 15,	Wednesday, Thursday and Friday,	Examinations for Admission.
June 17,	Sunday,	Baccalaureate Sermon.
June 19,	Tuesday,	Class Day.
June 20,	Wednesday,	Alumni Day.
June 21,	Thursday,	University Day.

1888-1889.

1888. Sept. 10–12,	Monday, Tuesday and Wednesday,	Examinations for Admission.
Sept. 12,	Wednesday,	First Term begins.
Oct. 11,	Thursday,	Founder's Day.
Nov. 29,	Thursday,	Thanksgiving Day.
Dec. 19,	Wednesday,	First Term ends.
1889. Jan. 8–9,	Tuesday and Wednesday,	Examinations for Admission to Second Term.
Jan. 9,	Wednesday,	Second Term begins.
June 20.	Thursday,	University Day.

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FONGER DE HAAN, C.N.L.,
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Instructor in Mining.

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Instructor in Mechanical Engineering.

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Instructor in Metallurgy and Mineralogy.

CHARLES W. MARSH, PH.D.,
Instructor in Organic and Industrial Chemistry.

JOSEPH W. RICHARDS, M.A., A.C.,
Assistant Instructor in Metallurgy and Blowpiping.

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Cataloguing Clerk,
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Shelf Clerk,
PETER F. STAUFFER.

STUDENTS.

Clas.—Classical Course.	C.E.—Civil Engineering.
L.S.—Latin-Scientific Course.	E.M.—Mining Engineering.
Sci.—Course in Science and Letters.	M.E.—Mechanical Engineering.
Tech.—Technical Course.	Met.—Metallurgy.
A.C.—Analytical Chemistry.	Elec.—Electricity.

The students whose names are printed in *italics* are not clear of conditions.

GRADUATES.

	For Degree.	Residence.
Robert Webb Barrell, B.M.,	E.M.,	New Providence, N. J.
Richard Singmaster Breinig, B.M.,	E.M.,	Breinigsville.
Harry Augustus Butler, B.S.,	M.S.,	Mauch Chunk.
Robert Grier Cooke, B.A.,	M.A.,	Bethlehem.
Francis Joseph Crilly, B.A.,	M.A.,	Philadelphia.
William Henry Dean, A.C., E.M.,	M.S.,	Clarence, Iowa.
George Francis Duck, E.M.,	Ph.D.,	Bethlehem.
Milton Henry Fehnel, B.S.,	A.C.,	Bethlehem.
Harvey Sheafe Fisher, B.A.,	M.A.,	Pottsville.
William Kendall Gillett, M.A.,	Ph.D.,	Bethlehem.
William Theodore Goodnow, C.E.,	M.S.,	Birmingham, Ala.
John Daniel Hoffman, B.A.,	M.A.,	Bethlehem.

	Course.	Residence.
Charles Colcock Jones, B.S.,	E.M.,	New Orleans, La.
Preston Albert Lambert, B.A.,	M.A.,	South Bethlehem.
Elmer Henry Lawall, C.E.,	M.S.,	Audenried.
Wilson Franklin More, B.A.,	M.A.,	Catasauqua.
Henry Benj. Chas. Nitze, B.S.,	E.M.,	Baltimore, Md.
George Spencer Patterson, E.M.,	M.S.,	Mahanoy City.
Rufus King Polk, B.S.,	E.M.,	Columbia, Tenn.
George Arthur Ruddle, Ph.B.,	M.A.	E. Mauch Chunk.
Lewis Buckley Semple, B.A.,	M.A.,	Bethlehem.
Harry Harkness Stoek, B.S.,	E.M.,	Washington, D. C.
William Patterson Taylor, B.A.,	M.A.,	Philadelphia.
Leonard Blakslee Treharn, B.A.,	M.A.,	Boston, Mass.
James Hollis Wells, C.E.,	M.S.,	New York, N. Y.
Henry Aug. Julius Wilkens, B.S.,	E.M.,	Baltimore, Md.
Frank Williams, B.S.,	E.M.,	Johnstown.
Wade Hampton Woods, B.S.,	E.M.,	Philadelphia.

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Charles Lambert Addison,	M.E.,	Reading.
Frank Fielding Amsden,	E.M.,	Scranton.
George Reade Baldwin,	M.E.,	Elmira, N.Y.
Charles Lincoln Banks,	Sci.,	Bridgeport, Conn.
Edmund A. Bates,	C.E.,	Charlestown, W.Va.
William Donaldson Beatty,	C.E.,	Pottsville.
Hubert Alexander Bonzano,	C.E.,	Phœnixville.
William Bradford,	C.E.,	Dover, Del.
Adolph Theodore Bruegel,	M.E.,	Syracuse, N. Y.

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Otto Cornelius Burkhardt,	E.M.,	Bethlehem.
Charles Noble Butler,	C.E.,	Uwchland.
Morton Lewis Byers,	C.E.,	Pittsburgh.
John Jesse Clark,	M.E.,	Corning, N. Y.
George Philip Connard,	C.E.,	Reading.
Augustus Crawford, jr.,	E.M.,	Baltimore, Md.
Reuben Daniels,	C.E.,	Saxton's River, Va.
George Herschel Davis,	C.E.,	Cavendish, Vt.
William Schaff Davis,	C.E.,	Reading.
Philip Hoffecker DeWitt,	C.E.,	Weatherly.
Manuel Victor Domenech,	C.E.,	Isabela, Porto Rico.
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George Steinman Franklin,	M.E.,	Lancaster.
Harry William Frauenthal,	A.C.,	Wilkes-Barre.
Samuel Wilson Frescoln,	C.E.,	Reading.
Louis Prevost Gaston,	E.M.,	Somerville, N. J.
William Gates, jr.,	C.E.,	Kittanning.
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Hughlett Hardcastle,	M.E.,	Easton, Md.
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Frederick Hayes Knorr,	A.C.,	Philadelphia.
Alfred Eli Lewis, jr.,	E.M.,	Milford.
Charles William Lohse,	C.E.,	Wheeling, W. Va.
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Howard Leoser McIlvain,	A.C.,	Reading.

	Course.	Residence.
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John Hoff Millholland,	C.E.,	Reading.
Harlan Sherman Miner,	A.C.,	Chester, Vt.
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Wyndham Harvey Stokes,	E.M.,	Gordonsville, Va.
Wilmer Marshall Webb,	M.E.,	Lancaster.
Harvey Musser Wetzel,	C.E.,	Bellefonte.
Winter Lincoln Wilson,	C.E.,	Elkton, Md.
Edward Benjamin Wiseman,	C.E.,	Elmira, N. Y.
Shuntaro Yamaguchi,	C.E.,	Tokio, Japan.
Luther Reese Zollinger,	C.E.,	Harrisburg.

JUNIOR CLASS.

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Pearce Atkinson,	M.E.,	Chicago, Ill.
Gustav Ayres,	M.E.,	Washington, D.C.
Ralph Putnam Barnard,	C.E.,	Washington, D.C.
Albert Harlan Bates,	M.E.,	Cleveland, O.
Samuel Erwin Berger,	Clas.,	Richland Centre.
Charles Hudson Boynton,	L.S.,	Washington, D.C.
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John Webster Dougherty,	E.M.,	Steelton.
Ralph Marshall Dravo,	E.M.,	Allegheny.
Albert Edward Duckham,	C.E.,	Pittsburgh.
Ernest Hipolite Du Vivier,	A.C.,	New York City.

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Thomas Franklin Newby,	C.E.,	Harrisburg.
Albert Daniel Oberly,	C.E.,	Easton.
Joseph Michael O'Malley,	A.C.,	Wilkes-Barre.
Robert Henry Eddy Porter,	M.E.,	Morristown, N. J.
Arnold Karthaus Reese,	E.M.,	Baltimore, Md.
Abraham Lincoln Rogers,	M.E.,	Fort Wayne, Ind.
Louis Augustus Round,	M.E.,	Providence, R. I.
José Ramon Villalon y Sanchez,	C.E.,	Santiago de Cuba, Cuba.
Charles William Schwartz, jr.,	M.E.,	Germantown.
Arthur Moult Smyth,	E.M.,	Philadelphia.

* Excused.

	Course.	Residence.
Alfred Walton Stockett,	C.E.,	Mauch Chunk.
Lester Clark Taylor,	C.E.,	Pawtucket, R. I.
Augustus Thompson Throop,	C.E.,	Port Gibson, N.Y.
Charles Prentice Turner,	M.E.,	Oxford, N. Y.
Clarence Walker,	E.M.,	Pottsville.
Harry Rush Woodall,	E.M.,	Philadelphia.
Walter Earle Weimer,	A.C.,	Lebanon.
Edward Austin Wright,	C.E.,	Northampton, Mass.
Joseph Bodine Wright,	C.E.,	South Easton.

SOPHOMORE CLASS.

	Course.	Residence.
Howard Emory Alcott,	M.E.,	Mt. Holly, N. J.
George Kerr Anderson,	L.S.,	Franklin.
Thos. Chalkley James Baily, jr.,	C.E.,	Newark, N. J.
George Barclay,	A.C.,	Bethlehem.
Frederick Richard Barrett,	C.E.,	Fort Selden, N. M.
Edwin Herbert Beazell,	C.E.,	Chillicothe, Mo.
Wesley Hudson Beck,	C.E.,	Utica, N. Y.
Herman Stadiger Borhek,	Sci.,	Bethlehem.
Charles Marcus Breder,	E.M.,	Bethlehem.
James W. Boyd,	C.E.,	Seek.
Adolph Cardenas,	C.E.,	Nicaragua.
Charles Baldwin Cassady,	C.E.,	Baltimore, Md.
Morgan Chace,	L.S.,	Elizabeth, N. J.
Frank Riley Chapman,	C.E.,	Steubenville, O.
Holden Thomas Chester,	M.E.,	Williamstown.
Franklin Clarke, Jr.,	M.E.,	Vincennes, Ind.
William Phelps Cleveland,	A.C.,	Waterville, N. Y.

	Course.	Residence.
Frank Raymond Coats,	E.M.,	Philadelphia.
Warren Scott Cope,	C.E.,	Philadelphia.
Charles Ellery Coxe,	E.M.,	Reading.
James Barlow Cullum,	A.C.,	Meadville.
John Rose Davis,	C.E.,	Phœnixville.
Clement Heyser Detwiler,	C.E.,	Ironbridge.
Daniel Edward Downey,	E.M.,	South Bethlehem.
Cornelius Dugan,	A.C.,	South Bethlehem.
Delevan Emery,	A.C.,	Bradford.
Walter Lowe Fairchild,	C.E.,	Hammondsport, N. Y.
Charles Edward Fink,	C.E.,	Harrisburg.
Frederick Elmer Fischer,	C.E.,	New York City.
Frank Roberts Fisher,	C.E.,	Philadelphia.
James William Flack, jr.,	M.E.,	Baltimore, Md.
John George Fleck,	C.E.,	Philadelphia.
Howard Augustus Foering,	Sci.,	Locust Valley.
Robert David Frey,	L.S.,	Centre Valley.
Eugene Uz Gibbs,	M.E.,	Mt. Holly, N. J.
Ralph Goodman,	C.E.,	Atglen.
George Ellsworth Greene,	C.E.,	Rochester, N. Y.
Harry Walter Harley,	M.E.,	Gloucester, N. J.
David Garth Hearne,	C.E.,	Wheeling, W. Va.
Julian Green Hearne,	C.E.,	Wheeling, W. Va.
James Stevens Bush Hollinshead,	E.M.,	Dayton, O.
Paul Depue Honeyman,	L.S.,	Bethlehem.
John Turner Hoover,	C.E.,	Philipsburg.
Frederic Kidder Houston,	M.E.,	New York City.
Alexander Chambers Howard,	E.M.,	Pittsburgh.
Christopher Gadsden Howe,	C.E.,	Charleston, S. C.
Amos Dey Kennedy,	M.E.,	Philadelphia.
Harry Hiram King,	M.E.,	Bethlehem.

	Course.	Residence.
William Vincent Kulp,	C.E.,	Norristown.
Henry Meyers Kurtz,	M.E.,	Allentown.
George Crist Landis,	C.E.,	Middletown.
Harry Kinzer Landis,	E.M.,	Landis Valley.
John Elmer Litch,	M.E.,	Steelton.
Simon Strock Martin,	E.M.,	Steelton.
Allan Moore Masser,	M.E.,	Scranton.
William David Matheson,	A.C.,	Brooklyn, N. Y.
Robert Sayre Mercur,	C.E.,	Wilkes-Barre.
Charles Herbert Miller,	E.M.,	Huntingdon.
Robert Douglas Millholland,	M.E.,	Reading.
Daniel McFarlan Moore,	M.E.,	Bethlehem.
George Nauman, jr.,	C.E.,	Lancaster.
Robert Engler Neumeyer,	C.E.,	Bethlehem.
Albert Nicholson Palmer,	C.E.,	Baltimore, Md.
William Cassidy Perkins,	C.E.,	Williamsport.
Asa Emory Phillips,	C.E.,	Washington, D.C.
Charles Wiltberger Platt,	A.C.,	New York City.
Edward Williams Pratt,	M.E.,	Fort Atkinson, Wis.
Edwin Jay Prindle,	M.E.,	Washington, D.C.
Wallace Carl Riddick,	C.E.,	Wake Forest, N. C.
John Stover Riegel,	M.E.,	Riegelsville, N. J.
Frank Weyman Ritchey,	C.E.,	Pittsburgh.
Joseph Edgar Sanborn,	A.C.,	Bellows Falls, Vt.
Ellis Anstett Schnabel,	Clas.,	Bethlehem.
Harry Johns Sherman,	C.E.,	Mount Holly, N.J.
Stewart Applegate Shimer,	M.E.,	Bethlehem.
William Calvin Shoemaker,	C.E.,	Reading.
Raymond Walton Smith,	C.E.,	Trenton, N. J.
Charles Hugh Stevenson,	C.E.,	Snow Hill, Md.
William Alston Stevenson,	M.E.,	Lewistown.

	Course.	Residence.
Joseph William Stone,	M.E.,	New Orleans, La.
Theodore Alfred Straub,	C.E.	Allegheny.
R. Paul Stout,	M.E.,	Audenried.
Francis Dupont Thomson,	M.E.,	Shanghai, China.
Charles Cookman Tompkinson,	M.E.,	Harrisburg,
Claud Allen Porter Turner,	C.E.,	Lime Rock, R. I.
Aaron Howell Van Cleve,	Sci.,	Easton.
William Alder Webb,	M.E.,	Bethlehem.
Fritz August Weihe,	M.E.,	Wonneberg, W. Prussia.
George Edward Wendle,	M.E.,	Philadelphia.
David Thomas Williams,	M.E.,	Catasauqua.
Herbert Wright,	M.E.,	Northampton, Mass.

FRESHMAN CLASS.

	Course.	Residence.
Hanson Entriken Atkins,	C.E.,	Pottsville.
William Alexander Auchinvole,	A.C.,	Harrisburg.
Murray Blachley Augur,	M.E.,	Washington, D. C.
Hugh Cunningham Banks,	M.E.,	Savannah, Ga.
Juan de la Rosa Barrios,	E.M.,	Bogota, U. S. Colombia.
John Mayall Beaumont,	M.E.	Scranton.
John Bush Beck, Jr.,	M.E.,	Williamsport.
Harry Weed Biggs,	C.E.,	Glendale, O.
Finus Earl Blakeney,	C.E.,	Little Rock, Ark.
James Edwin Boatrite,	C.E.,	Columbus, Ga.
Frederick Carl Bredt,	A.C.,	Bethlehem.
George Briggs,	M.E.,	Scranton.
Jacob Burr Buckley,	M.E.	Oxford, N. Y.
Walter Frederick Burden,	C.E.,	Washington, D. C.

	Course.	Residence.
Frederick Stanley Camp,	M.E.,	Brooklyn, N. Y.
Edwin Chapman,	C.E.,	Catasauqua.
George Vose Chandler,	E.M.,	Washington, D. C.
Emanuel Chao,	C.E.,	Cienfuegos, Cuba.
Henry Clark, Jr.,	E.M.,	Montgomery City, Mo.
John Alexander Colwell,	A.C.,	Kittanning.
James Mosgrove Colwell,	A.C.,	Kittanning.
John Charles Connolly,	M.E.,	South Bethlehem.
Charles Houghton Corbin,	A.C.,	Telluride, Col.
Edward Haviland Coxe,	C.E.,	Reading.
Warden Cresson,	M.E.,	Swarthmore.
Andrew Gilbert Croll,	C.E.,	Weatherly.
Bernard Alphonsus Cullen,	C.E.,	Spruce Creek.
James F. Cullen,	C.E.,	Spruce Creek.
Roland Thomas Davies,	C.E.,	Catasauqua.
Francis Hewette Davis,	M.E.,	Watkins, N. Y.
Frederick Davis,	C.E.,	Watkins, N. Y.
Herman Haupt Davis,	M.E.,	Philadelphia.
Morgan Davis,	E.M.,	Mt. Carmel.
John William DeMoyer,	C.E.,	Houtzdale.
Percival Drayton,	E.M.,	Philadelphia.
Abben Eavenson,	A.C.,	Philadelphia.
Harry S. Eckert,	A.C.,	Reading.
William Parker Ely,	C.E.,	Lambertville, N. J.
Fitz Daniel Ermentrout,	L.S.,	Reading.
Juan de la Cruz Escobar,	M.E.,	Matanzas, Cuba.
Walter Famaris,	C.E.,	Beverly, N. J.
Willis E. Fertig,	L.S.,	Titusville.
Arthur Haldeman Fetters,	M.E,	Barneston.
George Buchanan Fife,	C.E.,	Washington, D. C.
Harry Alton Fitzjarrell,	C.E.,	Easton, Md.

	Course.	Residence.
Walton Forstall,	M.E.,	Chicago, Ill.
Harry Fulmer,	C.E.,	Philadelphia.
Samuel Morrison Graham,	M.E.,	Phillipsburg.
John Stilwell Griggs,	M.E.,	Lakeville, Conn.
Irwin Lorenzo Hartman,	C.E.,	Hockendauqua.
George Samuel Hayes,	Sci.,	Painesville, O.
John Sidney Heilig,	M.E.,	Catasauqua.
John Franklin Hersh,	C.E.,	Allentown.
Hermann Victor Hesse,	E.M.,	Bethlehem.
Ralph Ridgway Hillman,	C.E.,	Wilkes-Barre.
William Ross Hillyer,	M.E.,	Port Richmond, N.Y.
Benjamin William Homans,	C.E.,	Brooklyn, N. Y.
William Jennings,	C.E.,	Harrisburg.
William Edward Johnson,	C.E.,	Glastonbury, Conn.
Juan Jose Jimenez,	C.E.,	Aguadilla, Porto Rico.
Henry Kemmerling,	C.E.,	Scranton.
Hermann Meriwether Knapp,	C.E.,	Louisville, Ky.
Harry Kramph,	C.E.,	North Platte, Neb.
Herbert Gilfillan Lamberton,	C.E.,	Franklin.
John LeDroit Langdon,	E.M.,	Buffalo, N. Y.
Frederic Curtiss Lauderburn,	Clas.,	Hazleton.
George Edwin Lefevre,	E.M.,	Panama, U.S.Colombia.
Henry Lefevre,	E.M.,	Panama, U.S.Colombia.
Charles McKnight, Leoser, jr.,	E.M.,	New York City, N. Y.
Frank King Leslie.	A.C.,	Sharon.
Henry Washington Lloyd, jr.,	M.E.,	Stanhope, N. J.
Joseph Simonson Lockwood,	M.E.,	Brooklyn, N. Y.
Nevin John Loos,	E. M.	Bethlehem.
Robert Montgomery Loper,	C.E.,	Bridgeton, N. J.
George Hillard Lynch,	C.E.,	Wilkes-Barre.
Joseph Macfarland,	A. C.,	Washington, D. C.

	Course.	Residence.
George Evans Meily,	A.C.,	Lebanon.
Victoriano Mendozo,	C.E.,	Gaudalajara, Mex.
John Zollinger Miller,	M.E.,	Harrisburg.
George Smuller Mish,	C.E.,	Middletown.
Frederick Kent Morris,	Sci.,	Moorestown, N. J.
Harry Timothy Morris,	M.E.,	Pottsville.
Horatio Whitemore Myrick,	Sci.,	Springfield, Mass.
Frank Hamilton McCall,	M.E.,	Binghamton, N. Y.
Alexander Leutze McClurg,	E.M.,	Chambersburg.
James Anderson McClurg,	C.E.,	Meadville.
Henry Stewart McKee,	E.M.,	Washington, D. C.,
Paul Mayo Paine,	C.E.,	Troy.
William Taylor Patterson,	M.E.,	Mahanoy City.
Joaquin Prieto,	M.E.,	Bogota, U. S. Colombia.
Edwin Addams Quier,	A.C.,	Reading.
James Pius Rafferty,	M.E.,	Chicago, Ills.
Edgar Randolph Reets,	C.E.,	Wilkes-Barre.
Walter Freeman Rench,	C.E.,	Cumberland, Md.
Wallace Chester Rice,	C.E.,	Bridgeton, N. J.
John Ira Riegel,	C.E.,	South Bethlehem.
Milton Holly Robbins, jr.,	M.E.,	Lakeville, Conn.
Robert Schmitz,	C.E.,	Egg Harbor City, N. J.
Anton Schneider,	C.E.,	Summit Hill.
Leidy Rudy Shellenberger,	C.E.,	Benjamin.
Frank William Brown Schutte,	A.C.,	Philadelphia.
Ira Augustus Shimer,	Clas.,	Redington.
Charles Henry Simpson,	C.E.,	Pensacola, Fla.
James Vincent Smith,	M.E.,	Franklin.
Matthew Charles Smith,	C.E.,	Birmingham, Ala.
Oscar Emmerson Smith,	C.E.,	Portsmouth, Va.
Michael Druck Sohon,	A.C.,	Washington, D. C.

	Course.	Residence.
William Buchecker Spengler,	M.E.,	Bethlehem.
Horace Theodore Stillson,	C.E.,	Cleveland, Ohio.
Mercer Brown Tate,	C.E.,	Middletown.
William Sidney Topping,	L.S.,	Sagg, N. Y.
Edwin Smith Townsend,	Sci.,	New York City, N. Y.
Domingo Anthony Usina,	C.E.,	Savannah, Ga.
Michael Neligan Usina,	M.E.,	Savannah, Ga.
Elias Vander Horst,	M.E.,	Charleston, N. C.
Henry Wadleigh,	Sci.,	South Bethlehem.
Joseph Wickes Welsh,	C.E.,	Washington, D. C.
Frank Shriver West,	A.C.,	Philadelphia.
Francis Nichols Whitney,	M.E.,	Pottsville.
George Brown Zahniser,	C.E.,	Mercur.
Roger Hanson Zimmerman,	E.M.,	Louisville, Ky.

ELECTRICALS.

	Residence.
Ira Ayer,	San Francisco, Cal.
Albert Brodhead,	Bethlehem.
Joseph Edwin Cochran,	Emporium.
William Fairchild Dean,	Seymour, Conn.
Frank Ross Durant,	Morristown, N. J.
John Clark Finney,	Milwaukee, Wis.
Chester Lyon Forsman,	Williamsport.
Herman Frauenthal,	Wilkes-Barre.
Richard Otto Albert Heinrich,	Gotha, Germany.
Joseph Allison Horner,	Bath.

	Residence.
William Henry Hubbard,	Beaver Falls.
Daniel Henry Jenkins,	Edwardsdale.
Charles Jacob Miller,	Bethlehem.
James Leidy Moore,	Moorestown, N. J.
Wilbur Wellesley Parker,	Bridgewater, Nova Scotia.
Charles Norris Robinson,	Germantown.
John Percy Ryon,	Pottsville.
Robert Crittenden Segur,	Morristown, N. J.
Harry Meyer Seitzinger,	Wilkes-Barre.
William Augustus Stedman,	New York, N. Y.
Charles Wesley White,	Utica, N. Y.
John Brinton Whitehead,	Pittsburgh.
Hugh Carlyle Young,	Wellsboro.

SPECIAL STUDENTS.

	Course.	Residence.
Allen Harwood Babcock,	A.C.,	Oakland, Cal.
Henry M. Byllesby,	M.E.,	New York, N. Y.
Henry Clinton Carter, B.S.,	A.C.,	New York, N. Y.
Charles Joseph Coll.	C.E.,	Broad Ford.
Wallis Eastburn Howe,	C.E..,	Reading.
Albert Edward Juhler,	A.C.,	Pomeroy, Ohio.
Edwin Kamerly MacNutt,	A.C.,	Wilkes-Barre.

SUMMARY OF STUDENTS BY CLASSES.

Graduates,	28
Seniors,	66
Juniors,	65
Sophomores,	91
Freshmen,	121
Students in Advanced Electricity,	23
Specials,	7
Total,	401

SUMMARY OF STUDENTS BY STATES.

Vermont,	3
Massachusetts,	4
Connecticut,	5
Rhode Island,	4
New York,	39
Pennsylvania,	212
New Jersey,	24
Delaware,	2
Maryland,	19
District of Columbia,	19
Virginia,	3
West Virginia,	4
South Carolina,	1
Georgia,	5
North Carolina,	2
Alabama,	2

Florida,	1
Louisiana,	2
Ohio,	8
Indiana,	2
Illinois,	3
Arkansas,	1
Wisconsin,	2
Iowa,	1
Missouri,	3
Kentucky,	2
Tennessee,	1
Kansas,	1
Colorado,	2
California,	2
Oregon,	1
Nebraska,	1
Mexico,	1
New Mexico,	1
Nicaragua,	1
Nova Scotia,	1
Porto Rico,	2
Cuba,	4
Jamaica,	1
England,	1
Greece.	1
United States of Colombia,	4
China,	1
Japan,	1
Germany,	2
Total,	401

SUMMARY OF STUDENTS BY COURSES.

SCHOOL OF GENERAL LITERATURE.

Classical Course,	19	
Latin-Scientific Course,	10	
Course in Science and Letters,	11	
		40

SCHOOL OF TECHNOLOGY.

Course in Civil Engineering,	148	
Course in Mechanical Engineering,	91	
Course in Mining Engineering,	56	
Course in Electrical Engineering,	23	
Course in Analytical Chemistry,	43	
		361
Total,		401

THE LEHIGH UNIVERSITY.

ORIGIN.

The Hon. ASA PACKER, of Mauch Chunk, during the year 1865, appropriated the sum of Five Hundred Thousand Dollars, to which he added one hundred and fifteen acres of land in South Bethlehem, to establish an educational Institution in the rich and beautiful Valley of the Lehigh. From this Foundation rose THE LEHIGH UNIVERSITY, incorporated by the Legislature of Pennsylvania in 1866. In addition to these gifts, made during his life-time, Judge Packer by his last will secured to the University an endowment of $1,500,000, and to the University Library one of $500,000.

DESIGN.

The original object of Judge Packer was to afford the young men of the Lehigh Valley a complete technical education for those professions which had developed the peculiar resources of the surrounding region. Instruction was to be liberally provided in Civil, Mechanical and Mining Engineering, Chemistry, Metallurgy, and in all needful collateral studies. French and German were made important elements in the collegiate course. A School of General Literature was part of the original plan, together with tuition in the ancient Classics.

FREE TUITION.

All these educational facilities are provided without charge. Through the generosity of the Founder, the Trustees were enabled, in 1871, to declare tuition FREE in all

branches and classes. The Lehigh University is open to young men of good character and suitable preparation from every part of our own land and of the world. To this fact the attention of the pupils of our public schools and of the graduates of classical institutions is especially called. Thus is offered, *without charge*, every facility for studying the professions of the Civil, Mechanical, Mining and Electrical Engineer, and of the Metallurgist and Analytical Chemist. In the Classical and Scientific departments of the School of General Literature instruction is given in the Classics, Sciences and Letters.

PUBLIC WORSHIP.

Prayers are held in the Packer Memorial Church of the University every morning and all students are required to be present.

Divine Service is held on every Sunday morning in the Church. The service is according to the forms of the Protestant Episcopal Church, under whose auspices the University was placed by its Founder. Attendance is required of every student, except in case of those connected with other religious bodies, to whom the President will grant permission at the beginning of each term (if requested by the parent or guardian, or by the student himself if he be 21 years of age) to attend during that term the place of worship of the body with which he is connected, where attendance on Sunday morning will be required.

SITE.

The situation of the Institution is healthful and beautiful. The region is famous for its railway and manufacturing enterprises; it possesses some of the richest iron and coal mines in our land, and thus gives the students rare facilities for confirming the teachings of the recitation room by the observation of the eye.

The University Buildings are about a half-mile from the depot, at the junction of the Lehigh Valley and North Pennsylvania Railroads. New York is ninety-two, and Philadelphia fifty-four miles distant.

BUILDINGS.

PACKER HALL,

named after the Founder, stands seven hundred feet back of Packer Avenue, at the base of the South Mountain. It is built of stone, and contains Lecture and Recitation Rooms, the Drawing Rooms and the Museum of Geology and Natural History.

THE CHEMICAL LABORATORY

is thoroughly fire-proof, is built of sandstone, and is 219 feet in length by 44 in width.

There are two principal stories and a basement. The upper floor is occupied by the quantitative and the qualitative chemical laboratories, the former accommodating 48 and the latter 84 students. These rooms are 20 feet in height, and are well lighted and ventilated. A laboratory for industrial chemistry and the supply room are also on this floor.

The first floor contains a large lecture room, a recitation room, a chemical museum and laboratories for organic, physiological, agricultural and sanitary Chemistry.

In the basement is the large laboratory for the furnace assay of ores and a well appointed laboratory for gas analysis, also rooms containing the apparatus for several processes in industrial chemistry, the engine and air-pump for vacuum filtration, a store room and the toilet.

A photographic laboratory is located in the third story of the central portion of the building.

THE METALLURGICAL LABORATORY

contains a lecture room, a blowpipe laboratory for class instruction in blowpipe analysis and in the practical determination of crystals and minerals, a museum for mineralogical and metallurgical collections, a mineralogical laboratory provided with a Fuess reflecting goniometer, a polariscope, a Groth's "universal apparat" and a Rosenbusch polarizing microscope, a dry laboratory provided with furnaces for solid fuel and for gas with natural draught and with blast,

and a wet laboratory for ordinary analytical work. It is arranged for the instruction of classes in the courses of mineralogy, metallurgy and blowpipe analysis of the regular curriculum, and to afford facilities to a limited number of advanced students to familiarize themselves with the methods of measurement and research employed in mineralogy and metallurgy, and to conduct original investigations in these departments of science.

THE PHYSICAL LABORATORY

consists of three stories. A large lecture room with a seating capacity of 150, occupies a portion of the second and third floors. It is well lighted and adapted to its purposes. On the remainder of these floors are two rooms, each 40 feet long, for Heat and Light laboratories, a dark room for photographic work, spectroscopic and apparatus rooms and the private laboratories of the instructors.

The lower floor is devoted to the use of the students in Electricity. A large room nearly 40 feet square is used as the Electrical Laboratory. There are smaller rooms for photometric and spectroscopic work, also reading, balance, apparatus and engine rooms. On this floor a 12 horse-power high speed engine and a dynamo supply two systems of electric lights, one of 25 incandescent lamps, the other of four arc lights, for practical tests in the Electrical Laboratory and for experimental purposes in the lecture room above. In the cellar are battery, store rooms, etc.

The tower and two rooms in the east end of Christmas Hall have been given to the Departments of Physics and will be equipped as a Meteorological Observatory.

THE SAYRE OBSERVATORY.

Near Brodhead Avenue is the Sayre Observatory, the gift of Robert H. Sayre, Esq., of South Bethlehem, containing an equatorial and a zenith telescope, transit instrument and astronomical clock.

THE UNIVERSITY LIBRARY.

To the east of Packer Hall is the University Library, erected by the Founder in memory of Mrs. Lucy Packer Linderman, his daughter.

THE GYMNASIUM

is a handsome and spacious structure, built and equipped with the utmost thoroughness. It is furnished with the best patterns of gymnastic apparatus, besides Dr. Sargent's system of Developing Appliances. It is provided with hot and cold water; tub, sponge and shower baths, and 329 clothes closets. Opportunities for recreation and amusement are provided in the billiard room and bowling alleys. It is under the immediate care of a skilled and competent Director.

All students are required to undergo a physical examination before being allowed the use of the Gymnasium, and this examination will be repeated once each year during their stay at the University. The proper exercise is prescribed and is required of every student. The aim of the Institution is to promote a harmonious symmetrical development best suited to the individual condition of the student.

EXPENSES.

Tuition is FREE in all branches and classes. Books, materials, paper, pencils, chemical materials used in the analytical laboratory and drawing instruments, are furnished by the student.

Rooms and Board can not be had in University buildings, but can readily be obtained in many private houses.

The following is an estimate of the necessary expenses for the collegiate year, clothing and traveling not included:

Board for 40 weeks, . . .	from $160 to $200
Room-rent, with fuel and lights .	40 " 80
Care of room and use of furniture,	5 " 20
Washing and incidentals, . . .	20 " 40
Books, stationery, etc., . . .	25 " 50
Total, ...	$250 to $390

NOTE.—If clubs be formed the cost of board need not exceed $3.50 per week.

ADMISSION OF STUDENTS.

ENTRANCE EXAMINATIONS.

Application for admission should be made to the President of the University, from whom all information may be obtained.

DATE OF EXAMINATIONS.

Examinations for admission to the University are held at the opening of each term, and also in June at the close of the Academic year.

The examinations for 1888 will be on Tuesday and Wednesday, January 10 and 11, for admission to the *second term;* on Wednesday, Thursday and Friday, June 13, 14 and 15, and on Monday, Tuesday and Wednesday, September 10, 11 and 12, for admission to the first term. No other examinations for entrance will be held, except for good cause, and all applicants *must* be in attendance at 8.30 on the morning of the first day.

The examinations are held in the following order:

First Day.—English Grammar, 9.00 A.M.; Geography, 11.30 A.M.; United States History, 2 P.M.; Physical Geography, 4 P.M.

Second Day.—Geometry, 9 A.M.; Arithmetic, 2 P.M.; Algebra, 3.30 P.M.

Third Day.—Latin and Roman History; Elementary Physics, 8.30 A.M.; Greek and Greek History, 2 P.M.

CHARACTER OF THE EXAMINATIONS.

The examinations are rigorous and cover the entire ground laid down in the following scheme. They are all conducted in writing, supplemented by an oral examination at the option of the examiner.

All candidates for admission must be at least sixteen years of age, must present testimonials of good moral character, and, must satisfactorily pass in the following subjects:

1. *English Grammar*, including composition, spelling and punctuation. It is recommended that candidates have a knowledge of Latin Grammar, although an examination in it is not required for any courses except the Classical and the Latin-Scientific.

2. *Geography*, general and political.

3. *History of the United States*, including the *Constitution*.

4. *Arithmetic*, including the metric system of weights and measures.

5. *Algebra*, Fundamental Principles. Factoring. Least Common Multiple. Greatest Common Divisor. Fractions. Involution. Evolution. Radicals. Imaginary Quantities. Equations of the First and Second Degrees. Ratio. Proportion and Progressions.

[Olney's University Algebra is recommended, as it is the text-book used in the University.]

6. *Geometry*, Fundamental Principles. Rectilinear Figures. The Circle. Proportional Lines and Similar Figures. Comparison and Measurement of the Surfaces of Rectilinear Figures. Regular Polygons. Measurement of the Circle. Maxima and Minima of Plane Figures. The Plane and Polyhedral Angles.

[Chauvenet's Geometry, (six books) is recommended, as it is the text-book used in the University.]

For admission to the various courses, *in addition* to the requirements above given, the examinations are as follows:

For the Course in Science and Letters, Civil, Mechanical, Mining and Electrical Engineering, and Analytical Chemistry.

7. *Elementary Physics.*

[Avery's Elements of Natural Philosophy (revised edition) is recommended.]

For the Latin-Scientific and Classical Courses.

8. *Physical Geography.*

9. *Latin Grammar*, (Harkness' preferred).

10. *Cæsar*, four books of the Gallic war.

11. *Cicero*, six orations, including the four against Cataline.

12. *Virgil*, the Bucolics and the first six books of the Aeneid, including Prosody.

13. The translation, at sight, of passages from Cæsar and Cicero.

14. The translation of English into Latin. (As special importance is given this part of the examination, it is suggested to teachers that they connect exercises in making Latin, both oral and written, with all the studies of the preparatory course.)

15. *Roman History.* Creighton's Primer of Roman History is suggested as indicating the amount required.

For the Classical Course only.

16. *Greek Grammar*, (Goodwin's preferred).

17. *Xenophon*, Anabasis, four books.

18. *Homer*, Iliad, three books, including Prosody.

19. The translation, at sight, of a passage from some work of Xenophon.

20. *Greek History.* Fyffe's Primer of Greek History is suggested.

21. Writing Greek with accents.

The pronunciation of Greek according to the written accents is followed in the University, and it is desirable that students preparing to enter be taught this system.

Division of Entrance Examinations.

Candidates for admission to the Freshman Class may pass all the examinations *at once* in June, or in September, or may take them in *two consecutive years.* In the latter case for the Technical courses and the course in Science and Letters, candidates may present themselves for examination in the first year in the following subjects: English

Grammar, Geography, History of the United States, and Arithmetic. No credit will be given unless the candidate has passed satisfactorily in at least three subjects at one examination.

The examinations in Algebra, Geometry and Physics must be passed in June or September of that year in which the candidate proposes to enter the University.

In the Latin-Scientific and Classical courses candidates may present themselves for examination in the first year in the following subjects: English Grammar, History of the United States, Arithmetic, Physical Geography, and Roman History. No credit will be given unless the candidate has passed at least four of the subjects at one examination.

The examination in Latin may also be divided, but no credit will be given unless the candidate has passed in at least three of the topics specified at one examination. The examination in the remaining subjects must be passed in June or September of that year in which the candidate proposes to enter the University.

Candidates intending to enter the University in September are advised to present themselves for examination in June; if they are not fully prepared at that time they will receive credit for the examinations then satisfactorily passed.

CONDITIONAL ADMISSION.

A candidate failing to pass in one or more of the subjects required for admission may, at the discretion of the Faculty, be admitted to his class conditionally, to make up his deficiencies by extra study. When they are made up, he will be received into full standing in his class.

SPECIAL STUDENTS.

Young men who do not desire to take a full regular course can enter and select special shorter courses, with the sanction of the Faculty; but in all cases satisfactory examinations must be passed upon the subjects required for admission to the Freshman class.

ADMISSION TO ADVANCED STUDIES.

Candidates for admission to advanced studies *in any course* are required to pass, *in addition to the entrance examinations for that course*, examinations in the work already done by the classes which they desire to enter. These examinations are held on the same days as those for admission to the Freshman class.

The additional subjects may be found in the programme of studies.

A diploma or, in so far as it covers the subjects required for admission, a certificate of studies taken at another College will be received in lieu of the *Primary Entrance Examinations only.*

ADMISSION TO THE POST GRADUATE COURSE.

Students of this University who have taken their *first* degree, and others, on presenting a diploma of an equivalent degree conferred elsewhere, are admitted to advanced studies, according to the plan to be found under the general subject of Graduate Students.

PREPARATORY SCHOOL CERTIFICATES

are not accepted so as to dispense with the primary entrance examination.

NOTE.—The acceptance of a certificate as evidence of proficiency in lieu of examination, is at the discretion of each Professor as to the subjects in his department.

PROGRAMME OF STUDIES,

Showing the number of exercises per week for each subject, and the Text-books used.

The following is presented as the general programme of instruction, subject to such modifications from time to time as the Faculty may deem expedient, with the approval of the Trustees.

The names of the text-books studied are generally mentioned. The number of exercises per week in each subject is indicated by the figure in parentheses immediately following.

Two hours of Drawing, three of work in the Laboratory, or three of practice in the field, are regarded as equivalent to a recitation or lecture of one hour's duration.

During the year, Prof. Ringer will deliver a course of lectures on the History of Europe, from the Congress of Vienna in 1815 to the Congress of Berlin in 1878.

SCHOOL OF GENERAL LITERATURE.

This school is intended to correspond to the course long established in our older colleges, modified by the needs and requirements of modern culture. Its object is to impart a comprehensive and liberal education to those who design to enter upon professional rather than technical pursuits.

It comprises three distinct courses:

I.—The Classical Course or Course in Arts.

II.—The Latin-Scientific Course or Course in Philosophy.

III.—The Course in Science and Letters.

THE CLASSICAL COURSE.

This course is chiefly designed for those who purpose to study Law and Theology; it includes full and rigorous in-

struction in the Ancient Classics, in Elementary Science and in General Literature. The study of Mathematics in this course embraces Algebra, Geometry, Trigonometry, Analytical Geometry, and the Calculus. The programme includes Physics, Chemistry and Elementary Mechanics. There are full courses in History, in the Science of Language and in the origin and growth of the English Language. There are also lectures on Psychology, the Christian Evidences, International and Constitutional Law and Political Economy. Lectures on English Literature are supplemented by critical readings of the standard English authors. The graduate in this course obtains the degree of Bachelor of Arts (B.A.).

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet) completed. (4)
Chemistry.—Lectures. Fownes' Elementary Chemistry. (4)
Greek.—Homer: Odyssey. Prosody. (3)
Latin.—Livy. Prose Composition. (2)
History.—History of Greece. (1)
Physiology and Health.—Lectures. (1)
English.—Exercises and Declamations. (1)
Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Pt. III. (3) Plane and Spherical Trigonometry and Mensuration. Use of Logarithmic tables. (2)
Greek.—Xenophon: Oeconomicus. (3)
Latin.—Cicero: De Amicitia. Horace: Odes and Epodes. Composition and Prosody. (4)
History.—History of Greece. (2) History of Rome. (1)
English.—Exercises and Declamations. (1)
Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical Geometry. Olney's General Geometry. (4)

Physics.—Lectures. (3)

French.—Chardenal. Keetel's Analytical Reader. Written and Oral Translations. (2) Or *German.*—Brandt's Grammar. Lodeman's Manual of Exercises. Joynes' Otto's Reader. (2)

Greek.—Herodotus. (2)

Latin.—Tacitus: Agricola and Germania. Composition. (2)

History.—History of Rome. (2)

English.—Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and Integral Calculus: Olney. (4)

French. — Grammar. Chardenal's French Exercises. Reader (continued). (2) Or *German.*—Grammar. Exercises and Reader (continued). (2)

English.—Coppée's Rhetoric, with Kellogg's Praxis. (1)

History.—Outlines of the World's History. (2)

Greek.—Euripides: Medea. (3)

Latin.—Quintilian: Book X. Horace: Satires and Epistles. Composition. (3)

Essays and Declamations. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Outlines of the World's History. (2)

Philosophy.—Coppée's Logic (2)

English.—Coppée's English Literature. (4)

French.—Grammar. Chardenal's Exercises. Written and Oral Translations. Chapsal: Littérature Française. (2) Or *German.*—Grammar. Translation from German into English and *vice versa.* Reading. (2)

Greek.—Sophocles: Electra. Antiquities. (3)

Latin.—Plautus and Terence. Roman Antiquities: Wilkins. (3)

Literature and History. (1)

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Porter's Elements of Intellectual Science. (2) Political Economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Grammar. O'Connor: Choix de Contes Contemporains. Gasc's Translator. Dictation. (2) Or *German.*—Grammar. Systematic Reading of various authors. Translation. Dictation. (2)

Greek.—Aristophanes: Clouds. (3)

Latin.—Juvenal and Persius. Pliny: Select Epistles. Cruttwell's History of Roman Literature. (3)

Essays and Original Orations. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire: Gibbon. (3)

Philosophy.—Moral Philosophy. (2)

Astronomy.—Loomis' Treatise, with Lectures. (3)

French.—Grammar. Saintsbury: Specimens of French Literature. Corneille; Racine; Molière; Contemporary authors. Lectures on French Literature. Compositions. (2) Or *German.*—Grammar. Systematic Readings. Ger-

man Compositions. Lectures on German Literature. (2) Conversation Class in both languages optional.

Greek.—Pindar: Selected Odes. Greek Literature. (2)

Latin.—Lucretius, with Lectures. Roman Literature. (2)

Essays and Original Orations. (1)

Gymnasium. (2)

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—History of Philosophy. (1) Philosophy of History. Lectures. (2)

Christian Evidences. (1)

French.—Systematic Readings. Compositions. Lectures on French Literature. Lectures in French on Modern French Authors. (2) Or *German.*—Systematic Readings. German Composition. Lectures on German Literature. Lectures in German on Modern German Authors. (2)

Geology.—Lectures. Le Conte. (2)

Greek.—Thucydides. Greek Literature completed. (2)

Latin.—Catullus, Tibullus and Propertius. Cicero: de Officiis, with Lectures. Roman Literature (completed). (2)

Lectures on American and English Literature. (2)

Preparation of Thesis.

Gymnasium.

THE LATIN SCIENTIFIC COURSE.

The Latin-Scientific Course leading to the degree of Bachelor of Science (B.S.) is based on Latin without Greek.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet) completed. (4)

Chemistry.—Lectures. Fownes' Elementary Chemistry. (4)

German.—Brandt's Grammar. Lodeman's Manual of Exercises. Writing in German Text. Translation into English. (3)

Latin.—Livy. Prose Composition. (2)
History.—History of Greece. (1)
Physiology and Health.—Lectures. (1)
English.—Exercises and Declamations. (1)
Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and Spherical Trigonometry and Mensuration. Use of the Logarithmic Tables. (2)
German.—Brandt's Grammar. Lodeman's Manual of Exercises. Translations: Joynes' Otto's German Reader. (3)
History.—History of Greece. (2) History of Rome. (1)
Latin.—Cicero: De Amicitia. Horace: Odes and Epodes. Composition and Prosody. (4)
English.—Exercises and Declamations. (1)
Gymnasium. (2.)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical Geometry: Olney's General Geometry. (4.)
Physics.—Lectures. (3)
French.—Chardenal. Keetel's Analytical Reader. Written and Oral Translations. (2)
German.—Brandt's Grammar. Lodeman's Manual of Exercises. Translations from German into English. (2)
History.—History of Rome. (2)
Latin.—Tacitus: Agricola and Germania. Composition. (2)
English.—Exercises and Declamations. (1)
Gymnasium. (2)

SECOND TERM.

Mathematics. — Differential and Integral Calculus: Olney. (4)

English.—Coppée's Rhetoric, with Kellogg's Praxis. (1)

French. — Grammar. Chardenal's French Exercises. Reader (continued). (2)

German. — Grammar. Systematic Readings of various authors. Translation. Dictation. (2)

History.—Weber's Outlines of the World's History. (2)

Latin. — Quintilian: Book X. Horace: Satires and Epistles. Composition. (3)

Essays and Declamations. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Weber's Outlines of the World's History. (2)

Philosophy.—Coppée's Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. Chardenal's Exercises. Written and Oral Translations. Chapsal: Littérature Française. (2)

German.—Systematic Readings of various authors. Lessing, Herder, Goethe, Schiller. Dictation. Compositions in German. (2)

Latin. — Plautus and Terence. Roman Antiquities: Wilkins. (3)

Literature and History. (1)

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Porter's Elements of Intellectual Science. (2) Political Economy. (1)

English. — Earle's Philology of the English Tongue. (2)

French. — Grammar. O'Connor: Choix de Contes Contemporains. Gasc's Translator. Dictation. (2)

German. — Systematic Reading of various authors (continued). Dictation. Compositions in German. (2)

Latin. — Juvenal and Persius. Pliny: Select Epistles. Cruttwell's History of Roman Literature. (3)

Essays and Original Orations. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History. — Decline and Fall of the Roman Empire: Gibbon. (3)

Philosophy.—Moral Philosophy. (2)

Astronomy.—Loomis' Treatise, with Lectures. (3)

French. — Grammar. Saintsbury: Specimens of French Literature. Corneille; Racine; Molière; Contemporary authors. Lectures on French Literature. (2)

German. — Systematic Readings of various German authors (continued). Lectures on German Literature. Compositions. (2) Conversation Class in both languages optional.

Latin.—Lucretius, with Lectures. Roman Literature. (2)

Essays and Original Orations. (1)

Gymnasium.

SECOND TERM.

Constitutional Law. — Lectures. (1)

History.—History of France. (2)

Philosophy. — History of Philosophy. (1) Philosophy of History. Lectures. (2)

Christian Evidences. (1)

Geology.—Lectures. Le Conte. (2)

Latin. — Catullus, Tibullus and Propertius. Cicero : de Officiis, with Lectures. Roman Literature (completed). (3)

French.—Systematic Readings. Compositions. Lectures on French Literature. Lectures in French on Modern French authors. (2)

German.—Lectures on German Literature. Lectures in German on Modern German authors. Compositions. (1)

Lectures on American and English Literature. (2)

Preparation of Thesis.

Gymnasium.

A COURSE IN SCIENCE AND LETTERS.

The Course in Science and Letters, leading to the Degree of Bachelor of Science (B.S.), is designed for those who wish to pursue both Scientific and Literary studies without Latin and Greek. These being omitted, extended instruction is given in French and German, History, General Literature, Mathematics and General Science.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry, (Chauvenet) completed. (4)

Chemistry.—Lectures. Fownes' Elementary Chemistry. (4)

German.—Brandt's Grammar. Lodeman's Manual of Exercises. Writing in German Text. Translation into English. (3)

Drawing.—Elementary Projections, Shading and Lettering. (2)

History.—History of Greece. (1)

Physiology and Health.—Lectures. (1)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and Spherical Trigonometry and Mensuration. Use of the Logarithmic Tables. (2)

Chemistry.—Qualitative Analysis. (3)

History.—History of Greece. (2) History of Rome. (1)

German.—Brandt's Grammar. Lodeman's Manual of Exercises. Translation. Joynes' Otto's German Reader. (3)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical Geometry: Olney's General Geometry. (4)

Physics.—Mechanics, Heat and Electricity. Lectures. (5)

French.—Chardenal. Keetel's Analytical Reader. Written and Oral Translations. (2)

German.—Brandt's Grammar. Lodeman's Manual of Exercises. Translations from German into English. (2)

History.—History of Rome. (2)

English.—Exercises and Declamation. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics. — Differential and Integral Calculus: Olney. (4)

Physics.—Sound, Light and Meteorology. Lectures. (3)

English.—Coppée's Rhetoric, with Kellogg's Praxis. (1)

French.—Chardenal. Keetel's Analytical Reader. Written and Oral Translations. (2)

German.—Grammar. Systematic Readings of various authors. Translation. Dictation. (2)

History.—Outlines of the World's History. (2)

Essays and Declamations. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Outlines of the World's History. (2)

Philosophy.—Coppée's Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. Chardenal's Exercises. Written and Oral Translations. Chapsal: Littérature Française. (2)

German.—Systematic Readings of various authors. Lessing, Herder, Goethe, Schiller. Dictation. Compositions in German. (2)

Zoology.—Lectures and Laboratory work. Tenney. (2)

Crystallography.—Lectures, with Practical Exercises in the determination of Crystals. (2)

Literature and History. (1)

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Porter's Elements of Intellectual Science. (2) Political Economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Grammar. O'Connor: Choix de Contes Contemporains. Gasc's Translator. Dictation. (2)

German.—Systematic Readings of various authors (continued). Compositions in German. (2)

Mineralogy.—Descriptive Mineralogy, with practical exercises in the determination of Minerals. (3)

Essays and Original Orations. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire. (3)

Philosophy.—Moral Philosophy. (2)

Astronomy.—Loomis' Treatise, with Lectures. (3)

French.—Grammar, Saintsbury: Specimens of French Literature. Corneille; Racine; Molière; Contemporary authors. Lectures on French Literature. Composition (2).

German.—Systematic Readings of various authors (continued). Lectures on German Literature. Compositions. (2)

[In both languages, Conversation Class *optional* throughout the year.]

Geology.—Lithology and Laboratory Practice. Formation of Strata. General Definitions of Geology. (2)

Essays and Original Orations. (1)

Gymnasium.

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—History of Philosophy. (1) Philosophy of History. Lectures. (2)

Christian Evidences. (1)

French.—Systematic Readings. Composition. Lectures on French Literature. Lectures in French on Modern French authors. (2)

German.—Lectures on German Literature. Lectures in German on Modern German authors. Composition. (1)

Geology.—Historic, Dynamic and Economic Geology. (2)

Lectures on American and English Literature. (2)

Preparation of Thesis.

Gymnasium.

THE SCHOOL OF TECHNOLOGY.

This School includes five distinct courses:

I. The Course in Civil Engineering.
II. The Course in Mechanical Engineering.
III. The Course in Mining and Metallurgy.
IV. The Course in Electrical Engineering.
V. The Course in Chemistry.

These have the same curriculum of studies for the first term of the Freshman year. At the end of that time the student selects his course and follows its programme.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Chauvenet's Geometry (completed). (4)

Chemistry.—Lectures. Fownes' Elementary Chemistry. (4)

German.—Brandt's Grammar. Lodeman's Manual of Exercises. Writing in German text. Translations into English. (3) Or *French.*—Chardenal. Keetel's Analytical Reader. (3)

Drawing.—Elementary Projections, Shading and Lettering. Descriptive Geometry. (2)

English.—Exercises and Declamations. (2)

Physiology and Health.—Lectures. (1)

Gymnasium. (2)

THE COURSE OF CIVIL ENGINEERING.

The special technical studies in this course may be grouped under the heads of Surveying, Applied Mechanics, Road and Railroad Construction, Bridge Design, and Hydraulic and Sanitary Engineering.

The work in Surveying extends over seven terms and embraces land surveying, leveling, topography, triangulation,

railroad reconnaissance and location, hydrography, and the elements of geodesy. A large equipment of transits, levels and other surveying tools, affords students the opportunity of becoming familiar with the instruments of different manufacturers. Much time is devoted to practice in the field and drafting room, each student being required to become proficient in the use of instruments, in taking field notes, and in map drawing. Particular attention is paid to the execution of a secondary triangulation of a high order of precision, and to the execution of topographical surveys and maps by the best modern methods.

The work in Applied Mechanics comprises the strength and elasticity of materials, the theory of the equilibrium of arches, roofs and bridges, that part of the mechanics of machinery which relates to locomotives and hoisting machines, and the theory of hydraulics and hydraulic motors. Here the theoretical principles are illustrated by examples and problems taken as far as possible from actual engineering practice.

The course in Construction familiarizes the student with the qualities of materials used in engineering structures, with methods of preservation and testing, with masonry and foundations, and with the building and maintenance of roads and railroads. Plans, drawings, and estimates of cost are prepared for the construction of a line of railroad, all details, such as drains, culverts, road crossings, etc., being worked out by each student.

The course in Bridge Design starts with the study of full specifications for a first-class iron highway or railroad bridge. Each student then makes the full computations, designs, working drawings, and bills of material for the particular span assigned him. The weight of the designed bridge is finally determined and compared with the dead load assumed for the calculations. The drawings are made and dimensioned in the same manner as in the drafting office of a bridge company. In connection with this course, visits of inspection to bridges in the vicinity are regularly made.

The work in Hydraulic and Sanitary Engineering em-

braces the study of systems of water supply, the collection, purification and distribution of water, the combined and the separate systems of sewerage, the methods for the disposal of sewage, and the best practice for the drainage and ventilation of houses. A hydraulic laboratory in the University Park affords opportunity for experiments on the actual measurement of water by means of weirs and orifices, and the testing of hydraulic motors.

Besides these special studies there is a course in astronomy which includes practical work in the observatory. The study of English, and of French or German, is continued, and instruction is given during four terms in crystallography, mineralogy, lithology and geology.

The student who completes all the studies of this course will receive the degree of Civil Engineer (C.E.)

FRESHMAN CLASS.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and Spherical Trigonometry and Mensuration. Use of Logarithmic Tables. (2)

Surveying.—Theory of Chain and Compass Surveying. Computation of Areas. Elements of Leveling. (1)

German.—Grammar and Exercises (continued). Joyne's Otto's Reader. Translations. (3) Or *French.*—Grammar. Keetel's Reader. Translations. (3)

Drawing.—Projection Drawing and Descriptive Geometry. (3) Freehand Drawing. (1)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical Geometry: Olney's General Geometry. (4)

Physics.—Mechanics, Heat, and Electricity. Lectures (5)

German.—Grammar. Exercises. Translations. Readings. (2) Or *French*—Grammar. Chardenal's Exercises. Readings. Translations (2)

Drawing.—Isometric Drawing. Architectural Drawing. (2)

Surveying.—Use of the Compass, Level and Transit. Surveys and Maps of Farms. Colored Topography. (2)

English.—Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and Integral Calculus: Olney. (4)

Physics.—Sound, Light and Meteorology. Lectures. (3)

German—Grammar. Exercises. Systematic Readings. Translations. Dictation. (2) Or *French.*—Grammar. Dictation. Chardenal's Exercises. O'Connor: Choix de Contes Contemporains. (2)

Mechanics.—Mathematical Theory of Motion. Science of Motion in General. Statics. Dynamics, and Statics of Fluids. Lectures on the Theory of Center of Gravity and Moment of Inertia. (4)

Surveying.—Profiles and Contour Maps. Hydrographic and City Surveying. Use of the Plane Table. Topographical Drawing. (3)

Essays and Declamations.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Integral Calculus: Courtenay. (2)

German.—Systematic Readings. Translation. Dictation. Compositions. (2) Or *French.*—Translation. Readings. Contemporary Authors. Saintsbury: Specimens of French Literature. (2) Conversation Class in both languages optional.

Surveying.—Triangulation. Leveling. Topographical Surveying with Transit and Stadia. Topographical Map. (4)

Strength of Materials.—Elasticity and Strength of Wood, Stone, and Metals. Theory of Columns, Shafts and Beams. Reports on the Testing of Materials. (4)

Construction.—Materials of Construction. Masonry. Foundations. Construction of Roads and Pavements. (2)

Crystallography.—Lectures, with practical exercises in the determination of Crystals. (2)

Literature and History. (1)

Gymnasium. (2)

SECOND TERM.

German.—Systematic Readings. Compositions. Lectures on German Literature. (2) Or *French.*—Reading. Dictation. Compositions. Lectures on French Literature. (2)

Surveying.—Theory of Railroad Curves. Railroad Reconnaissance and Location. Survey of a Line, with Profile, Map and Estimate of cost. (4)

Roofs and Bridges.—Theory and Calculation of Strains in Roof and Bridge Trusses. (2)

Construction.—Stone cutting, with practical Drawings. (3) Construction and Maintenance of Railroads. Theory of Retaining Walls and Stone Arches. (2)

Mineralogy.—Descriptive Mineralogy, with practical exercises in the Determination of Minerals. (3)

Essays and Original Orations

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Astronomy.—Loomis' Treatise, with Lectures. (3)

Graphical Statics.—Analysis of Stresses in Roof Trusses, Bridge Trusses, and Arches. (2)

Bridges.—Suspension, Continuous and Cantilever Bridges. Design of an Iron Bridge, with Working Drawings. (6)

Surveying.—Use of Solar Transit and Sextant. (1)

Mechanics of Machinery.—Pile Drivers, Cranes, and Elevators. The mechanics of the Locomotive. (2)

Geology.—Lithology, with practical exercises in determining rocks. (2)

Gymnasium.

SECOND TERM.

Astronomy.—Doolittle's Practical Astronomy, with Observatory Work. (2)

Surveying.—Elements of Geodesy. The Figure of the Earth. Map Projections Elements of the Method of Least Squares. (2)

Hydraulics.—Hydrostatics. Efflux of water from orifices, and flow in pipes and rivers. Hydraulic motors. (2)

Hydraulic and Sanitary Engineering.—Collection, Purification and Distribution of Water. Systems of Water Supply. The Combined and the Separate System of Sewerage. Disposal of Sewage. House Drainage. Hydraulic Experiments. (5)

Geology.—Historic and dynamic. Le Conte. (2)

Lectures on English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis

Gymnasium.

THE COURSE OF MECHANICAL ENGINEERING.

The object of this course is the study of the Science of Machines; the principal subjects taught are: the nature, equivalence and analysis of mechanisms, the mechanics or theory of the principal classes or types of machinery, Mechanical Technology and the principles and practice of Machine Design.

That the students may obtain the practical engineering data which they will most need when beginning their work

as mechanical engineers, they are required to pursue a course of Shop Instruction which does not necessarily involve manual labor and manipulation of tools, but is principally devoted to familiarizing them with those points in pattern-making, moulding, forging, fitting and finishing, which they need to know as designers of machinery. Particular attention is therefore directed to the forms and sizes of machine parts that can be readily constructed in the various workshops, to the time that it takes to perform, and the order of, the various operations, to the dimensions most needed by workmen and to the various devices for increasing the accuracy of the work, durability of the parts and convenience of manipulation. This involves acquaintance with the processes and machinery of the workshops, but it is the foreman's and superintendent's knowledge which is required rather than the manual dexterity and skill of the workman and tool hand. The acquirements peculiar to the latter are by no means despised, and students are encouraged to familiarize themselves therewith during leisure hours, but manual work in the shops forms no regular part of the course. On the contrary, the student enters the shop with hands and mind free to examine all the processes, operations and machinery, and is ready at the call of the teacher, to witness any operation of special interest. Provided with note-book, pencil, calipers and measuring rule, the student sketches the important parts of the various machine-tools, notes down the successive steps of each of the important shop-processes as illustrated by the pieces operated upon, and follows pieces of work through the shops from the pig or merchant form to the finished machine.

That the students may learn to observe carefully and be trained to think and observe for themselves in these matters, there is required of them a full description of the various processes, operations and tools involved in the production of each one of a series of properly graded examples of patterns, castings, forgings and finished pieces which are not being constructed in the shops at the time and the

blue prints for which have been given to them on entering the shops. The student's work is directed not only by these drawings and by the printed programme given him at the start, but also personally by a teacher, who accompanies him into the shops, gives necessary explanations, and tests the extent and accuracy of his knowledge by examining the sketches and notes and by frequent questioning. Finally the results of the observations and the sketches are embodied in a memoir.

During the course there are frequent visits of inspection to engineering works, both in and out of town, with special reference to such subjects as Machine Elements, Prime Movers, Machinery for lifting, handling and transporting, and Machinery for changing the form and size of materials. It is intended that each of these excursions shall have some definite purpose in view which must be fully reported upon by the students.

The instruction in Machine Design, during the second term of the Junior year, consists in determining rational and empirical formulas for proportioning such machine parts as come under the head of fastenings, bearings, rotating, sliding and twisting pieces, belt and toothed gearing, levers and connecting rods, also in comparing recent and approved forms of these same parts with respect to their advantages as regards fitness, ease of construction and durability, and in making full-sized working drawings of these parts; all the dimensions are determined by the students from the above mentioned-formulas, the data being given as nearly as possible as they would arise in practice. During the Senior year the students undertake the calculations, estimates and working drawings involved in the design of a simple but complete machine, each student being engaged upon a different machine. From the finished drawings of each machine, tracings are made and then blue prints taken for distribution among the other members of the class. The whole class also take up the design of a steam engine, every dimension being determined by the students, and complete working-drawings made. In the case of the

simple machines and of the steam engine, the general plan or arrangement will be given to the students in the form of rough sketches, photographs or wood-cuts This work will continue to the middle of the last term of the Senior year. From this time on the students are expected to make original designs for simple mechanisms, whose object has been fully explained. Throughout the course the work in the draughting room is carried on as nearly as possible like that of an engineering establishment, and special attention is paid to methods of expediting the work of calculation by means of simple formulas, tables and diagrams.

The graduate in this course will receive the degree of Mechanical Engineer (M.E.).

FRESHMAN CLASS.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and Spherical Trigonometry and Mensuration. Use of Logarithmic Tables. (2)

German.—Grammar and Exercises (continued). Joynes' Otto's Reader. Translations. (3) Or *French.*—Grammar. Keetel's Reader. Translations. (3)

Drawing.—Projection Drawing and Descriptive Geometry. (3) Freehand Drawing. (2)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical Geometry: Olney's General Geometry. (4)

Physics.—Mechanics, Heat and Electricity. Lectures. (5)

Drawing.—Isometrical Drawing. Architectural Drawing. (2)

Visits of Inspection.—Shops of the vicinity. (2)

German.—Grammar. Exercises. Translations. Readings. (2) Or *French.*—Grammar. Chardenal's Exercises. Readings. Translations. (2)

English.—Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics. – Differential and Integral Calculus: Olney. (4)

Physics.—Sound, Light and Meteorology. Lectures. (3)

German.—Grammar. Exercises. Systematic Readings. Translations. Dictation. (2) Or *French.*—Grammar. Dictation. Chardenal's Exercises. O'Connor: Choix de Contes Contemporains. (2)

Mechanics.—Mathematical Theory of Motion. Science of Motion in general. Statics. Dynamics and Statics of Fluids. Lectures on Theory of Center of Gravity and Moment of Inertia. (4)

Steam Engine.—Rigg's Practical Treatise. (3)

Essays and Declamations. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Integral Calculus: Courtenay. (2)

German.—Systematic Readings. Translation. Dictation. Compositions. (2) Or *French.*—Translations. Readings. Contemporary authors. Saintsbury: Specimens of French Literature. (2) Conversation Class in both languages optional.

Mechanical Technology.—Shop instruction. Examination of the processes and appliances involved in pattern making, moulding, forging, fitting and finishing, with sketches and reports. (7)

Boilers.—Wilson. Strength, construction and wear and tear of boilers. (1)

Strength of Materials.—Elasticity and strength of wood, stone and metals. Theory of beams, shafts and columns. Reports on experimental tests. (4)

Literature and History. (1)

Gymnasium. (2)

SECOND TERM.

German.—Systematic Readings. Compositions. Lectures on German Literature. (2) Or *French.*—Reading. Dictation. Compositions. Lectures on French Literature. Conversation Class in both languages optional. (2)

Kinematics of Machinery. Reuleaux. Nature and Equivalence of Mechanisms. (3)

Machine Design.—Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods. (5)

Metallurgy.—Metallurgical Processes. Furnaces. Refractory Building Materials. Combustion. Natural and Artificial Fuels. Metallurgy of Iron. (4)

Machinery of Transmission.—Weisbach-Herrmann. (2)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Thermodynamics.—General principles; application to Steam Engines and Air Compressors. (3)

Graphical Statics.—Graphical Analysis of Roof Trusses and Girders. (2)

Machine Design.—Calculations and working-drawings for a High-speed Steam Engine. (4)

Kinematics.—Diagrams of the changes of position, speed and acceleration in mechanisms. Link and valve motions. Quick return motions. Parallel motions. Laying out of Cams. (3)

Mechanics of Machinery.—Weisbach-Herrmann. Hoisting Machinery, Accumulators, Cranes and Locomotives. (4)

Gymnasium.

SECOND TERM.

Mechanics of Machinery.—Weisbach-Herrmann. Pumps, Pumping Engines, Blowing Engines, Compressors and Fans. (4)

Machine Design.—Calculations and working-drawings for the following machines: Drilling, Shaping, Milling, Shearing and Punching Machines, Hoists, Pumps and Stone Crushers. Original Designs. (5)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels; hydraulic motors. (2)

Measurement of Power.—Indicating of Steam Engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE IN MINING AND METALLURGY.

This course aims to fit the student for practical work in either of the branches of Mining, Metallurgy, Metallurgical Chemistry, or Geology. On account of the great number and scope of the studies necessary to the completion of this course, it is five years in length. At the completion of the fourth year the student will have completed a course similar to that leading to the Scientific degree in

other institutions and will receive the degree of Bachelor of Science in Mining and Metallurgy (B.S).

The graduate in this course will receive the degree of Engineer of Mines (E.M.), which includes that of Metallurgist.

CHEMISTRY.—The course in Theoretical and Applied Chemistry extends over three years and includes the methods of wet and dry Assaying and Blowpipe analysis combined with the working of Stoichiometric problems and the Study of Chemical Philosophy. The practical work is that required for a Metallurgical Chemist or Assayer.

With moderate care the expenses in this department need not exceed $120.

METALLURGY.—This course extends over one year and, after treating of the principles of the subject, enters minutely into the processes for the extraction and separation of metals from ores, with details of the necessary plants required and costs of extraction. A special laboratory attached to this department affords practical work in metallurgical problems.

GEOLOGY.—Three terms are devoted to Crystallography, Mineralogy, and Macroscopic Lithology. In each study, after a grounding of the theory of the subject, there is an extended course in practical determination of the most important species. There are from three to four hundred specimens to illustrate the first study and from three to five thousand hand specimens for each of the two latter. A year is then given to dynamic, historic and economic Geology, and this is supplemented by field work and the construction of maps and sections.

ASTRONOMY.—After studying the theory of the subject, two thirds of the year are devoted to practical work in the Observatory.

APPLIED MECHANICS.—This embraces Hydraulics, a study of the Steam Engine and the mechanics of machines employed in Mining and Metallurgy.

SURVEYING.—A course extending over five terms offers practice in land, mine, and geological surveying, leveling, topography, triangulation, and railroad reconnaissance and location. It also includes practical work in drawing and map construction.

MINING.—This course covers the theory and practice of locating and winning deposits with a full discussion of and practice in the engineering problems occurring in Mining, such as haulage, pumping, ventilation and hygiene, ore-dressing, and mining Law. A series of projects supplement the problems and give practical studies in Mining and Metallurgy.

The location of the University in the vicinity of the iron works of the Lehigh Valley and especially of the extensive establishment of the Bethlehem Iron Company, affords unusual facilities for the practical study of iron metallurgy. The processes for the manufacture of spelter and oxide of zinc may be studied at the Bethlehem Zinc Works. The facilities for the practical study of mining and economic geology are not excelled by those of any other Institution in the country. The zinc mines at Friedensville and the brown hematite and slate deposits of the Lehigh Valley are in the immediate vicinity, while within easy reach by rail are the anthracite coal fields of Pennsylvania, the iron and zinc mines of New Jersey, and the celebrated iron mines at Cornwall, Pa.

FRESHMAN CLASS.

SECOND TERM.

Mathematics.—Olney's University Algebra, Pt. III. (3) Plane and Spherical Trigonometry and Mensuration. Use of Logarithmic tables. (2)

German.—Grammar and Exercises (continued). Joyne's Otto's Reader. Translations. (3) Or *French.*—Grammar. Keetel's Reader. Translations. (3)

Drawing.—Projection Drawing and Descriptive Geometry. (3) Freehand Drawing. (1)

Surveying.—Theory of Chain and Compass Surveying. Computation of Areas and Leveling. (1)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics. — Analytical Geometry: Olney's General Geometry. (4)

Physics.—Mechanics, Heat and Electricity. Lectures. (5)

German.—Grammar. Exercises. Translations. Reading. (2) Or *French.*—Grammar. Chardenal's Exercises. Readings. Translations. (2)

Drawing. — Isometric Drawing. Architectural Drawing. (2)

Surveying.—Use of the Level and Transit. Surveys and Maps of Farms. Colored Topography. (2)

English.—Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics. — Differential and Integral Calculus: Olney. (4)

Mechanics.—Mathematical Theory of Motion. Science of Motion in general. Statics. Dynamics and Statics of Fluids. Lectures on Theory of Center of Gravity and Moment of Inertia. (4)

Chemistry.—Lectures and Laboratory Practice. Douglass and Prescott's Qualitative Analysis. (4)

Stoichiometry. (2)

German.—Grammar. Exercises. Systematic Readings. Translations. Dictations. (2) Or *French.* — Grammar. Dictation. Chardenal's Exercises. O'Connor: Choix de Contes Contemperains. (2)

Essays and Declamations.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Integral Calculus: Courtenay. (2)

Strength of Materials.—Elasticity and strength of wood, stone and metals. Theory of beams, columns and shafts.(4)

Crystallography.—Lectures, with Practical Exercises in the determination of Crystals. (2)

Surveying.—Triangulation. Leveling. Topographical Surveys with Transit and Stadia. Topographical Maps. (4)

Chemical Philosophy.—Cooke. (3)

German.—Systematic Readings. Translation. Dictation. Compositions. (2) Or *French.*—Translation. Readings. Comtemporary Authors. Saintsbury: Specimens of French Literature. (2) Conversation Class in both languages optional.

Literature and History.

Gymnasium. (2)

SECOND TERM.

Mineralogy.—Descriptive Mineralogy, with Practical Exercises in the Determination of Minerals: E. S. Dana. (3)

Blow-Pipe Analysis.—Lectures, with Practice. Plattner, Brush, or Nason and Chandler. (1)

Chemistry.—Fresenius' Quantitative Analysis. (3) The following analyses are executed by the student:

1. Iron Wire (Fe)
2. Copper Ore (Cu)
3. Silver Coin (Au, Ag, Pb, Cu)
4. Zinc Ore (Zn) By both Gravimetric and Volumetric Methods.
5. Bronze (Cu, Sn, Zn, Pb)
6. Spiegeleisen (Mn)
7. Lead Ore (PbS)
8. Ilmenite (TiO_2)
9. Iron Ore (Complete Analysis)

Steam Engine.—Rigg's Practical Treatise. (3)

Surveying.—Theory of Railroad curves. Railroad Reconnaissance and Location. Survey of a Line, with Profile, Map and Estimate of cost. (4)

German.—Systematic Readings. Compositions. Lectures on German Literature. (2) Or *French.*—Reading. Dictation. Compositions. Lectures on French Literature. (2) Conversation Class in both languages.

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Thermodynamics.—General principles; application to Steam Engines and Air Compressors. (3)

Geology.—General Geological Definitions and Principles. Dynamic Geology. (2)

Lithology.—Theory, with practical exercises in determining rocks. (3)

Chemistry.—Quantitative Analysis: Laboratory Work: Fresenius. (5) The following analyses are executed by the student:

10. Limestone (Complete Analysis)
11. Coal (Volatile Matter, Fixed Carbon, Ash, H_2O, S, P)
12. Slag (Complete Analysis)
13. Pig Iron (Complete Analysis)
14. Carbon in Steel (Volumetric)
15. Nickel Ore (Ni, Co)
16. Gas Analysis.

Assaying.—Including the Assay by the dry methods of Gold, Silver, Antimony, Mercury, Lead, Iron and Tin ores. Laboratory Work. Ricketts. (3)

SECOND TERM.

Metallurgy.—Metallurgical Processes. Furnaces. Refractory Building Materials. Combustion. Natural and Artificial Fuels. Metallurgy of Iron. (4)

Mining.—Modes of Occurrences of the Useful Minerals. Searching for Mineral deposits. Examination of Mining Properties. Boring. Mining Tools, Machines and Processes. Timbering and Masonry. Callon. André. Lectures. (3)

Geology.—Historic and Economic Geology. Lectures. Le Conte. Dana. (4)

Blow-pipe Analysis.—Practice. (1)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (2)

Surveying.—Mine Survey. Theory and Practice, with construction of Mine Maps. Tunneling and Shaft location. (2)

Gymnasium.

POST-SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of Copper, Lead, Silver, Gold, Platinum, Mercury, Tin, Zinc, Nickel, Cobalt, Arsenic, Antimony and Bismuth. (5)

Mining.—Methods of Working. Underground Transportation. Hoisting, Drainage and Pumping. Ventilation and Lighting. Hygiene of Mines. (4)

* *Mechanics of Machinery.*—Weisbach-Herrmann. Hoisting Machinery, Accumulators, Cranes. (2)

Astronomy.—Descriptive Astronomy: Loomis. (3)

* *Surveying.*—Geological Survey: Mapping and cross-sectioning. (2)

SECOND TERM.

Mining.—Mechanical Preparation of Ores. Coal Washing. (2)

Mechanics of Machinery.—Pumps, Pumping-Engines, Blowing-Engines, Compressors and Fans. (4)

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* The Surveying is completed in the first half of the term by taking four exercises per week. The Mechanics of Machinery is then begun.

Astronomy.—Doolittle's Practical Astronomy, with Observatory Work. (2)
Drawing.—Mining Plant. Systems of Timbering. (3)
Projects.—In Mining, Geology and Metallurgy. (2)
Lectures on American and English Literature. (2)
Christian Evidences.—Lectures. (1)
Preparation of Thesis.

THE COURSE IN ELECTRICAL ENGINEERING AND PHYSICS.

This course will replace in September 1888, the present one year's Advanced Course in Electricity. The Freshman and Sophomore Classes only will then be formed, as the necessary equipments and facilities for the instruction of the higher classes have not yet been completed.

The degree of Electrical Engineer (E.E.) will be given to the graduates of this course.

In the arrangement of the details of this new course, the object has been to provide for those, who seek to fit themselves as Electrical Engineers, a preliminary training as complete and broad as that given to the members of the other schools. The requirements for admission, the mathematical and English studies, the modern languages and other outside branches are the same as those in the other technical courses. To these have been added such portions of the Mechanical Engineering Course, with which this course is most closely allied, as are necessary to give the student a general, but sufficiently accurate knowledge of machinery.

This preparation joined to the unusually full development of Physics—and especially of Electricity—will, it is thought, make a course sufficiently comprehensive and thorough for the proper training of candidates for this degree. The great success attending the large majority of the young men who have taken the one year's Course in Electricity, in their subsequent electrical work, warrants

the belief that this broader and more extended course will attain its object.

The main feature of this new course is the prominence given to the subject of Physics. This extends through three years and while Electricity is specially developed, the other branches, Elementary Mechanics, Heat and Light are fully provided for. The opportunity is thus given to any one, who wishes to acquire a more extensive knowledge of Physics than the University curriculum has heretofore offered. The student is well drilled in the theory by means of lectures and recitations, which carefully cover the whole subject and he is required to go over the ground himself in the best of all schools—the working laboratory. Enough of work on each topic is given him to render him familiar with his subject. Much prominence is given to work that brings out the resources of the student himself, such as the construction of instruments and original investigation. He is encouraged to this and a regular portion of his time is set apart for this object.

FRESHMAN CLASS.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and Spherical Trigonometry and Mensuration. Use of Logarithmic Tables. (2)

Chemistry. – Lectures and Laboratory Practice. Douglass and Prescott's Qualitative Analysis. (2)

German.—Grammar and Exercises (continued). Joynes' Otto's Reader. Translations. (3) Or *French.*—Grammar. Keetel's Reader. Translations. (3)

Drawing.—Projection Drawing. Descriptive Geometry. Freehand Drawing. (3)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics. — Analytical Geometry: Olney's General Geometry. (4)

Mechanics, Sound and Heat.—(Theory, lectures and recitations.) (3)

Mechanics.—(Physical Laboratory). Exact Measurements. Density. Elasticity. Tenacity. Hydrostatics. Specific Gravity. Atmospheric Pressure (with barometric leveling.) Gravitation. Moments of Inertia.

Sound.—Determination of velocities and wave lengths. Measurements of vibrations. Verifications of laws of vibrations of sounding bodies.

Heat.—Construction of Instruments. Thermometry. Expansion. Conduction. Radiation. (4)

Drawing.—Isometrical Drawing. Architectural Drawing. 2)

German.—Grammar. Exercises. Translations. Readings. (2) Or *French* —Grammar. Chardenal's Exercises. Readings. Translations. (2)

English. - Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics. — Differential and Integral Calculus: Olney. (4)

Heat.—Continued. (Physical Laboratory.) Fusion and Vaporization. Calorimetry. Hygrometry. Elementary Thermodynamics. (3)

German.—Grammar. Exercises. Systematic Readings. Translations. Dictation. (2) Or *French.* — Grammar. Dictation. Chardenal's Exercises. O'Connor: Choix de Contes Contemporains. (2)

Mechanics. — Mathematical Theory of Motion. Science of Motion in general. Statics. Dynamics and Statics of

Fluids. Lectures on Theory of Center of Gravity and Moment of Inertia. (4)

Steam Engine.—Rigg's Practical Treatise. (3)

Essays and Declamations.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Integral Calculus: Courtenay. (2)

German.—Systematic Readings. Translation. Dictation. Compositions. (2) Or *French.*—Translations. Readings. Contemporaneous authors. Saintsbury: Specimens of French Literature. (2) Conversation Class in both languages optional.

Light and Magnetism.—(Theory; text-books and lectures.) (3)

Light.—(Physical Laboratory). Investigation of general Principles and Laws. Determination of Focal Lengths and Indices of Refraction, Testing and Adjustment of Optical Instruments. Spectroscopic Analysis. Photometry. Polarization. Diffraction.

Magnetism.—Fundamental Experiments. Verification of Laws of Magnets. Study and Mapping of Lines of Force. Determination of Moments of Magnets; and of horizontal component and whole intensity of Earth's Magnetism in absolute units. Distribution of Magnetism. (3)

Meteorology.—Text-book and practice. Observations for several months as taken in the U. S. Signal Service stations; with all the usual corrections and reductions; construction of charts; mapping curves; reports etc. (1)

Strength of Materials.—Elasticity and strength of wood, stone and metals. Theory of beams, columns and shafts. (4)

Boilers.—Wilson. Strength, construction and wear and tear of boilers. (1)

English.—Exercises and Declamations.

Gymnasium. (2)

SECOND TERM.

Electricity.—(Theory ; text-books and lectures. (3)

Static Electricity.—(Physical Laboratory). Investigation of Principles. Quantitative Laws. Measurements of Potential, Capacity, etc. Induction. Condensation. Analysis of Machines.

Voltaic Electricity.—Management and care of a large variety of batteries. Construction of Instruments. Determination of Constants. Electro-Magnetism. Induction. Electro-Dynamics. Electrical Measurements of Potential, Resistance and Current Strength. Electrolysis. Electroplating. Electrotyping. Thermo-Electricity. Secondary Batteries. Relation of Electrical Currents to Heat and Mechanical Work. (5)

German.—Systematic Readings. Compositions. Lectures on German Literature : Deutsche Literatur. (2) Or *French.*—Reading. Dictation. Compositions. Lectures on French Literature. Conversation Class in both languages, optional. (2)

Machine Designs.—Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods. (5)

Literature and History.—Lectures. (1)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Dynamic Machines.—Theory, text-book and lectures. (2) (Physical Laboratory). Practical running and care of dynamos and motors. Measurements of magnetic field, potential, resistance and heating. Visits to manufactories and working systems. (2)

Electric Lighting.—Lectures. (2) (Physical Laboratory). Study of different systems. Calculations and arrangement

of plant. Wiring. Insulation. Photometric tests of different arc and incandescent lamps. Determination of heat units given off by various incandescent lamps; their resistance (hot and cold). Energy consumed in lamps and conductors. Spectroscopic tests of purity of carbons. (3).

Machine Design.—Calculations for a High Speed Steam Engine. (2)

Astronomy.—Loomis' Treatise, with Lectures. (3)

Graphical Statics of Mechanism.—Herrmann Smith. (2)

Scientific Readings.

Gymnasium.

SECOND TERM.

Telegraphs and Telephone.—Investigation of different systems. Arrangement of lines and stations. Test of lines for conductivity, insulation, location of faults etc. (2)

Application of Electricity to Railways.—Theory of the two systems, with inspection of electric railways. (1)

Measurement of Power.—Indicating of Steam Engines; dynamometer experiments. (1)

Dynamic Machines.—(Physical Laboratory). Tests of Efficiency in Generators and Motors etc. (1)

Physics.—Original Investigation. (5)

English Literature.—Lectures on English and American Literature. (2)

Christian Evidences. (1)

Preparation of Thesis.—(With laboratory work).

Gymnasium.

THE COURSE IN CHEMISTRY.

This course of study is designed to prepare students for the profession of the Chemist, in connection with metallurgical establishments, sugar refineries, gas works, superphosphate works, electrical machinery manufactories, mining companies, etc., and the general consulting and

analytical work of the Professional Chemist. It is also well adapted for the preparation of teachers of chemistry and as a preliminary course to the study of medicine. It is eminently practical, the student's time being largely occupied by practical work in the large, well equipped and well ventilated chemical laboratories, which were completed in 1885 and constitute the best contructed building for this purpose in this country. The museum of Chemistry contains large collections of specimens, illustrating theoretical and applied chemistry, for illustrating the lectures on these subjects.

THEORETICAL CHEMISTRY.—Instruction in this subject begins with lectures four times a week, in the first term of the Freshman year; these lectures are fully illustrated by experiments, colored diagrams, working drawings and lantern pictures and specimens from the museum. These lectures include a general introduction to Theoretical Chemistry and a description of the non-metallic and metallic elements and their compounds, the general subject of inorganic chemistry. The students are required to take notes of the lectures, and to pass a written examination at the end of the term.

In the second term of this year Stoichiometry and chemical problems and reactions are taught by recitations twice each week.

The study of Theoretical Chemistry is continued throughout the Sophomore year, by recitations three times a week from Cooke's Chemical Philosophy and is concluded in the first term of Junior, by a course of lectures and recitations on Theoretical Organic Chemistry, four times a week. These lectures are illustrated by experiments and by specimens from the museum of Chemistry.

Written examinations are held at the close of each of the above courses.

ANALYTICAL CHEMISTRY. — Qualitative Analysis is taught in the second term of the Freshman year, by lectures, recitations and practical work in the Qualitatlve Labora-

tory, twelve hours of practical work per week being required. This laboratory is a large, well ventilated and well lighted room, and supplied with convenient working tables, vacuum filtration, hoods for noxious vapors, steam baths, gas and washing appliances and a commodious room for hydrosulphuric acid. Distilled water is delivered by faucet in this room and the other large laboratories. At the close of the term a practical examination is held in this subject.

After completing this course, Quantitative Analysis is taken up throughout the Sophomore and the first term of the Junior years. This subject is taught by lectures, recitations and practical work in the Quantitative Laboratory, which is equipped similarly to the Qualitative Laboratory, but is supplied in addition with apparatus for drying precipitates and residues, rooms for the chemical balances, for combustions, and for a reference library.

Twelve hours per week are required during the first term of the Sophomore year and fifteen hours during the second term of that year and the first term of the Junior year.

The course consists in Gravimetric and Volumetric Analyses, as applied to the substances given in the lists farther on, accuracy being required in the determination of each constituent.

At the close of each term, written and oral examinations are held upon the theory and practice of Quantitative Analysis.

Gas Analysis is taught by lectures and laboratory practice in the Gas Laboratory. This laboratory is supplied with full and complete apparatus for Gas Analysis, according to Bunsen's processes, as well as apparatus for some of the more rapid methods. Mixtures of gases are required to be analyzed by the students, within certain limits of error, and a written examination, on the theory and practice, is held at the close of the course.

Assaying.—The Assaying of ores by furnace assay, together with gold and silver bullion analysis, by processes

practiced in the United States Mint, is taught by lectures and practical work in the first term of the Junior year, nine hours of practical work per week being required. The course includes the assaying of ores of lead, tin, antimony, gold, silver and iron, coal, and gold and silver bullion.

The Assaying Laboratory is supplied with large working tables, twenty-nine crucible and two iron furnaces, and eight muffle furnaces, with adjoining rooms for balances, and gold and silver bullion analysis.

A certain accuracy of results and a written examination as regards the theory and practice are required.

ORGANIC CHEMISTRY.—The practical work in this subject is performed in the second term of the Junior and first term of the Senior years, fifteen hours during the former and twelve hours during the latter term being required, with conferences and recitations each week. The laboratory for this work is equipped similarly to the Quantitative Laboratory, in addition being supplied with steam heat, cold water and air blast upon the working tables, and a full supply of apparatus for the various determinations and experiments, including combustion furnaces, furnaces for heating sealed tubes, mercury pump, Hoffman's, Dumas' and Meyers' apparatus for vapor densities, nitrometers, chemical balances, etc.

The course consists of determinations of specific gravities, melting points, boiling points, vapor densities, chlorine, bromine, iodine and sulphur of organic substances.

Combustion analysis, nitrogen determination, fractional distillation, and the preparation of several pure organic compounds and their analysis are included.

INDUSTRIAL CHEMISTRY. — A course of lectures is delivered upon this subject in the second term of the Senior year, illustrated by experiments, diagrams, lantern pictures and specimens from the museum of Chemistry. The working laboratory for this subject contains an apparatus for making illuminating gas, an alcohol still, worm and doubler and a complete working model of a sugar refinery, includ-

ing filters, vacuum pan and centrifugal. In connection with this laboratory is a room containing a photometer and apparatus for determining the sulphur, ammonia and specific gravity of illuminating gas; also a laboratory for the testing of alcoholic liquors, sugar, molasses, bone black, soap, petroleum, paints, dyes, superphosphates and other commercial products, with the necessary technical apparatus. The students make practical experiments in this direction, and, with an instructor, visit various industrial establishments in this neighborhood and in and around New York City.

Toxicology.— A course of lectures on this subject is given in the first term of the Junior year, illustrated by experiments and by the large collection of specimens of poisons from the museum of chemistry. This is supplemented by a short course of laboratory work on some of the common poisons.

Sanitary Chemistry. — During the second term of the Senior year, attention is given to the qualitative and quantitative examination of air, water, food, disinfectants, and other subjects connected with this branch of the science. Special apparatus is provided for this work, as recommended by the best authorities on the subject.

Photographic Chemistry. — Well equipped Photographic Laboratory and dark rooms are provided, in which the students of the chemical course receive practical instruction.

Physiological Chemistry. — The examination of urine, blood, etc., receives a proper amount of attention.

The course also includes instruction in physics, mineralogy, blowpipe analysis, metallurgy and geology, which are of great value to the chemist.

In the last term of the Senior year, the student is required to prepare a Thesis on some subject, selected by the Professor of Chemistry, involving practical work in the laboratory in addition to the literary labor, each graduate

thus making a contribution to the progress of the science, as a preliminary to the reception of his degree.

The graduate of this course receiving the degree of Analytical Chemist. (A.C.)

Students, not candidates for a degree, are admitted for special courses in chemistry, of which they receive certificates.

The Laboratories are under the immediate charge of the Professor and Instructors of Chemistry and are open to the students from 8 o'clock, A.M., to 6 o'clock, P. M., including Saturdays. Students are at liberty to work in the Laboratories, beyond the required hours, as their time may permit. Students are charged for materials and apparatus consumed; with moderate care this expense need not exceed $50 per year.

FRESHMAN CLASS.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and Spherical Trigonometry and Mensuration. Use of Logarithmic Tables. (2)

Chemistry.—Lectures and Laboratory Practice. Douglass and Prescott's Qualitative Analysis. (4)

German.—Grammar and Exercises (continued). Joynes' Otto's Reader. Translations. (3) Or *French.*—Grammar. Keetel's Reader. Translations. (3)

Stoichiometry. (2)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Chemical Philosophy.—Cooke. (3)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (4)

The following analyses are executed by the student:

1. Iron Wire (Fe)
2. Potassium Dichromate (Cr_2O_3)
3. Barium Chloride (Ba, Cl, H_2O)
4. Magnesium Sulphate (MgO, SO_3, H_2O)
5. Disodium Hydrogen Phosphate (P_2O_5)
6. Rochelle Salt (K_2O, Na_2O)
7. Volumetric Determination of Chlorine.
8. Acidimetry (HCl, H_2SO_4, HNO_3, $HC_2H_3O_2$)
9. Alkalimetry (KOH, NaOH, NH_4OH, Soda Ash, Pearl Ash)
10. Chlorimetry (Bleaching Powders)

Quantitative Analysis—Conference. (1)

Physics.—Mechanics, Heat and Electricity. Lectures. (5)

German.—Grammar. Exercises. Translations. Reading. (2) Or *French.*—Grammar. Chardenal's Exercises. Readings. Translations. (2)

English.—Exercises and Declamations. (1)

Gymnasium. (2).

SECOND TERM.

Physics.—Sound, Light and Meteorology. Lectures. (3)

German.—Grammar. Exercises. Systematic Readings. Translations. Dictation. (2) Or *French.*—Grammar. Dictation. Chardenal's Exercises. O'Connor: Choix de Contes Contemporains. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

11. Copper Ore (Cu)
12. Zinc Ore (Zn). By both Gravimetric and Volumetric Methods.
13. Lead Ore (Pb, S)
14. Silver Coin (Au, Pb, Ag, Cu)
15. Spiegeleisen (Mn)
16. Copper Alloys. (Complete Analysis.)

17. Ilmenite (TiO_2)
18. Iron Ore (Complete Analysis)
19. Limestone (Complete Analysis)
20. Coal (Volatile Matter, Fixed Carbon, Ash, H_2O, S, P)
21. Slag (Complete Analysis)

Quantitative Analysis.—Conference. (1)

Blow-Pipe Analysis.—Lectures, with Practice. Plattner, Brush, or Nason and Chandler. (1)

Chemical Philosophy. (3)

Essays and Declamations. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Toxicology.—Lectures. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

22. Guano (NH_3, P_2O_5, H_2O)
23. Clay (Complete Analysis)
24. Manganese Ore (MnO_2)
25. Mineral Water (Complete Analysis)
26. Pig Iron (Complete Analysis)
27. Nickel Ore (Ni, Co)
28. Carbon in Steel (Volumetric)
29. Gas Analysis.

Quantitative Analysis.—Conference. (1)

Organic Chemistry.—Lectures and Recitations. (4)

Crystallography.—Lectures, with Practical Exercises in the Determination of Crystals. (2)

German.—Systematic Readings. Translation. Dictation. Compositions. (2) Or *French.*—Translation. Readings. Contemporary authors. Saintsbury: Specimens of French Literature. (2) Conversation Class in both languages optional.

Gymnasium. (2)

SECOND TERM.

Organic Chemistry.—Laboratory. (5)

Organic Chemistry.—Conference. (1)

Metallurgy.—Metallurgical Processes. Furnaces. Refractory Building Materials. Combustion. Natural and Artificial Fuels. Metallurgy of Iron. (4)

German.—Systematic Readings. Compositions in German. Lectures on German Literature. (2) Or *French.*—Systematic Readings. Compositions. Lectures on French Literature. Conversation Class in both languages optional. (2)

Mineralogy.—Descriptive Mineralogy, with Practical Exercises in the Determination of Minerals. E. S. Dana. (3)

Essays and Original Orations. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of Copper, Lead, Silver, Gold, Platinum, Mercury, Tin, Zinc, Nickel, Cobalt, Arsenic, Antimony and Bismuth. (5)

Assaying.—Including the Assay by the dry methods of Gold, Silver, Antimony, Lead, Iron and Tin ores, Coal, Gold and Silver Bullion and rich Lead. Ricketts. (3)

Organic Chemistry.—Laboratory. (4)

Organic Chemistry.—Conference. (1)

Geology.—Lithology, with Practical Exercises in determining rocks. (3)

Gymnasium.

SECOND TERM.

Industrial Chemistry.—Lectures and Laboratory. (4)

Agricultural Chemistry.—Lectures. (1)

Sanitary Chemistry.—Laboratory. (1)

Geology.—Historic and Dynamic Geology. Lectures. Le Conte. (2)

Christian Evidences.—Lectures. 1)
Lectures on American and English Literature. (2)
Preparation of Thesis. (5)
Gymnasium.

THE COURSE IN ELECTRICITY.

[NOTICE.—This course will be continued during the present University year of 1887-88; after which it will be replaced by the new four years' course in Physics and Electrical Engineering.]

This course was established to answer the growing demand for more extensive and thorough knowledge of the subject of Electricity and its application to Machines, Telegraphy, Electric Lighting, etc.

Instead of an extended department of Electrical Engineering including full courses of Mathematics, Mechanics, Chemistry, etc., and extending over four years, it was thought best to offer for the present a course, occupying not more than one year and presenting very fully the purely electrical portion of an Electrical Engineering course, with only such outside branches as are absolutely necessary for the proper understanding of this single subject.

FIRST TERM.

Magnetism and Electricity.—Text-book (S. P. Thompson) and Lectures. Electrical Arithmetic (Day's). (5)

Mechanics.—(Laboratory work.) Precise Measurements with beam-compass, spherometer, cathetometer, micrometers, etc. Testing balances. Specific gravities of solids, liquids and gases by all known methods, with balances, hydrometers, comparison of densities and cathetometer, etc.; with corrections for temperature and buoyancy of air, etc. Laws of gravity, with determinations by Atwood's machine, pendulum, etc. Elasticity; Young's modulus by stretching, flexure and torsions, tenacity of wires, superficial tension by capillary tubes of different liquids. Work with

mercurial and aneroid barometers, with all corrections and reductions, to freezing point, sea level, etc.; measurement of heights and leveling roads. (3)

Magnetism and Static Electricity. — (Laboratory work.) Making and testing permanent magnets. Verification of laws by Coulomb's torsion balance. Measurements of portative force, strength of pole, effects of heating, percussion, etc. Study of the distribution of magnetism and drawing magnetic curves. Investigation of local attraction, variation of magnetic needle and intensity of the earth's magnetism.

Construction of electroscopes, condensers. Determination of electrical character of many substances. Verification of laws of electrical attraction and repulsion. Measurements of conductivity, electric density and capacity. Study of laws of Static induction, specific inductive capacity, etc., and of condensers. Analysis of machines, electrophorus, plate glass machines, Holtz's, etc. (5)

Meteorology.—Text-book (Loomis) and practice. Observations for one month as taken in the U. S. Signal Service stations; with all the usual corrections and reductions; construction of charts; mapping curves, etc. (5)

Drawing. — Elementary Projections. Freehand Drawing. (3)

SECOND TERM.

Dynamic Machinery.—Text-book (S. P. Thompson) and lectures.

Electric Lighting.—Text-book (Du Moncel) and lectures.

Telegraph.—Lectures. (5)

Sound, Heat and Light.—(Laboratory work.) Determination of number of vibrations of notes with Siren, comparison of pitch of tuning forks. Determination of velocity of sound in air. Verification of laws of vibrations of strings. Determination of absolute pitch of notes by the monochord and of wave lengths of notes by sensitive flames. Making and testing thermometers; determinations of freezing and boiling points of different substances; of coefficients of

expansion of solids, liquids and gases; of specific heat of bodies by the known methods and of latent heat of fusion and vaporization. Humidity by various methods. Verification of the laws of light. Photometry; testing intensities of lights with Bunsen's, Rumford's, Foucault's and daylight photometers. Tests of absorptive power of different substances. Index of Refraction of unknown substances by various methods. Measurements of focal lengths of lenses and mirrors. Construction of optical instruments, finding magnifying power, etc. Spectroscopic work; mapping Frauenhofer lines; identification of unknown substances in solution; absorption spectra (solids and liquids); comparison of spectra; mapping of spectra. Interference. Diffraction spectra. Construction of polariscopes; laws of polarization by reflection and double refraction. Study of uniaxial and biaxial crystals. (3)

Dynamic Electricity.—(Laboratory work.) Setting up, use and care of all batteries in common use, Grove's, Daniel's, LeClanchè's, Bichromate, Bunsen's, Smee's, Gravity, etc.; Secondary batteries, Plantè's, Faure's. Construction of electro-magnets; tests for portative force and strength of pole under varying conditions of current strength, size of wire, number of coils, length and diameter of cores, etc. Laws of currents. Electro-Dynamics. Testing thermo-electric batteries, Noë's and Clamond's. Electrolysis, electrotyping and electroplating. Making induction coils; testing different orders of induced currents and extra currents. Similar study of magnetic induction. Analyses and tests of electro-magnetic and dynamic machines. Diamagnetism. (5)

Electrical Measurements.—(Laboratory work.) Practical construction of instruments; sine, tangent and differential galvanometers, ammeters, voltameters, resistance coils, commutators, etc. Verification of Ohm's laws under varying conditions of electromotive force and external and internal resistance. Measurement of resistance of solid and liquid conductors in single and divided circuits; and of effects of change in temperature: of internal resistance,

electromotive force and current strength of voltaic batteries. Measurements of quantitative laws of electrolysis, comparisons of voltameters and galvanometers. Testing electric lights, measurements of potential of incandescent lamps; their resistance, hot and cold and amount of heat units given off. Photometric measurements of incandescent lamps; Swan's, Lane-Fox's, Maxim's, Edison's, etc.; and of arc lamps, Weston's, Thompson-Houston's, etc. Spectroscopic study of all these lights and mapping their spectra.

Photographing the lines of force of the field magnets of various types of dynamos. Measurements of current strength, difference of potential and resistance of dynamos. Study of different plants and systems of dynamos by visits to manufactories and working systems.

Telegraphic measurements; measuring and testing lines for conductivity, insulation, location of faults, etc. (2)

PHYSICAL CULTURE.

The Gymnasium is open morning, afternoon and evening, in all, 45 hours a week. Exercise in it is required of all students who are fitted to take it. Class drill with the Instructor and individual exercise are prescribed.

GRADUATING THESES.

Every student will be required to present a thesis upon some topic connected with his special course, as a necessary portion of the exercises for his final examination for a diploma. These theses shall be accompanied by drawings and diagrams, when the subjects need such illustration. The originals will be kept by the University, as a part of the student's record, for future reference; but a copy may be retained by the student, and be published, permission being first obtained from the President.

DIPLOMAS AND CERTIFICATES.

The Diploma is given only to those who have passed all the examinations in a regular course and is signed by the President and Secretary of the Board of Trustees and by the Faculty of the University. For all the partial courses a certificate, signed by the President and the Secretary of the Faculty, is given showing what the student has accomplished.

GRADUATE STUDENTS.

Graduate students wishing to remain a year or more and pursue a course of study as candidates for another Degree may do so with the sanction of the Faculty. Those wishing to take *special* courses of study will be afforded every facility for so doing.

POST GRADUATE DEGREES.

M. A.

The Faculty will recommend for the Degree of Master of Arts any Candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Arts, shall pursue, for at least one year at this University, or two years elsewhere, a course of liberal study prescribed by the Faculty in at least two departments, pass a satisfactory examination in the same and present a satisfactory Thesis.

M. S.

The Faculty will recommend for the Degree of Master of Science any Candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Science, or any Degree in the School of Technology, shall pursue, for at least one year at this University, or two years elsewhere, a course of study prescribed by the Faculty in at least two departments, pass a thorough examination in the same and present a satisfactory Thesis.

Ph. D.

The Faculty will recommend for the Degree of Doctor of Philosophy any Candidate, otherwise properly qualified, who, after taking at this University the Degree of Master of Arts or Master of Science, shall pursue, for at least one year at this University, or two years elsewhere, a course of advanced study prescribed by the Faculty, in at least two departments, pass a thorough examination in the presence of the Faculty in the same and present a satisfactory Thesis giving evidence of original investigation.

The Candidate shall have a good knowledge of Latin and either French or German.

The Theses presented by Candidates for Post Graduate Degrees shall be retained by the University.

Applicants for any of these degrees will be required to complete the prescribed work within the allotted time. Special action of the Faculty is required for any extension of time.

THE UNIVERSITY LIBRARY.

The Library building was erected by the Founder of the University in 1877, at a cost of One Hundred Thousand Dollars, as a memorial of his daughter, Mrs. Lucy Packer Linderman, and during the same year more than Twenty Thousand Dollars were contributed by her family and friends, as a memorial fund for the purchase of books. By the will of the Founder of the University a fund of $500,000 has been given for the permanent endowment of the library.

The building is semi-circular in plan, with a handsome façade in the Venetian style of architecture. It is constructed of Potsdam sandstone with granite ornamentation. In the interior, the center is occupied as a reading space, fifty by forty feet, from which radiate the book cases, extending from floor to ceiling; two galleries affording access to the upper cases. Shelf room is now provided for one hundred and sixty thousand volumes. The building is thoroughly fireproof, well lighted, and heated by steam.

Sixty-seven thousand volumes are now upon the shelves, including many extremely valuable works. The list of periodicals numbers about one hundred and twenty-five, embracing as far as possible all departments of knowledge.

The Library is conducted strictly for consultation, and is open to the use of the public; both of which conditions are in accord with the terms of the gift.

REGULATIONS OF THE LEHIGH UNIVERSITY LIBRARY.

I. The Library is open every day, except Sundays and Legal Holidays, from 8 A. M. until 10 P. M., and on Sundays for the students and others connected with the University from 1.30 P. M. until 9.30 P. M.

II. Admission is free to all persons over 16 years of age.

III. Readers are required to write their names and addresses in the Daily Register of the Library. They also write the name of the book desired upon a Library Card, with their signatures, and present the same to the Director's Clerk, who supplies the book, retaining the card as a receipt. Before leaving the Library, readers return their books to the clerk, and receive their cards.

IV. The University Professors and Instructors, only, are allowed to take books from the Library Building.

V. No person is allowed to enter the alcoves, or remove any book from the shelves, without permission of the Director.

VI. Readers wishing to consult the more valuable illustrated works make special application for that purpose.

VII. In taking notes, pencils, and not pens and ink, are to be used.

VIII. Audible conversation and the use of tobacco are strictly forbidden in any part of the Library.

IX. Any person not conforming to these Regulations, will be denied the privilege of the Library.

X. Any person, who defaces, in any way, any book, magazine or paper, or the furniture, or any portion of the building, in addition to being deprived of the privileges of the Library, will be prosecuted according to law.

OBSERVATORY.

By the liberality of Robert H. Sayre, Esq., one of the Trustees of the University, an Astronomical Observatory was erected on the University grounds, and placed under the charge of the Professor of Mathematics and Astronomy.

In the dome of the Observatory is mounted an Equatorial Telescope, of six inches aperture, by Alvin Clark & Sons. The west wing contains a superior Sidereal Clock, by Wm. Bond & Sons; a Zenith Telescope, by Blunt, and a Field Transit, by Stackpole. There is also a Prismatic Sextant, by Pistor & Martins.

Students in Practical Astronomy receive instruction in the use of the instruments and in actual observation.

The grounds upon which the Observatory stands, consisting of seven acres of land adjoining the original grant, was presented to the University by Charles Brodhead, Esq., of Bethlehem.

An advanced course in Astronomy and the higher Analysis has been established, requiring two years for its completion. It is adapted to the attainments of the graduates of this University, but, is open to any one who may be prepared to pursue it.

This course embraces the following subjects:

First Year.—Spherical Astronomy. Theory of Instruments. Method of Least Squares. Numerical Calculus.

Second Year.—Celestial Mechanics. Interpolation and Quadrature. Computation of Orbits and Perturbations.

During the entire course the student will have ample opportunity to familiarize himself with the practical work of the Observatory and Computing Room.

THE PACKER MEMORIAL CHURCH,

is the recent and munificent gift of Mrs. Mary Packer Cummings, daughter of the Founder of the University. It is a large and magnificent Church, richly furnished and handsomely appointed in every particular. There is no more beautiful Church edifice in the State and it is one of the noblest in all the land. It is under the Rectorship of the Right Reverend Nelson Somerville Rulison, D.D., Assistant Bishop of Central Pennsylvania, with the Chaplain of the University as Assistant.

THE UNIVERSITY MUSEUM.

In addition to the large collection illustrating all branches of Industrial Chemistry, the Museum includes collections in Metallurgy, Geology, Zoology, and Archæology.

The Metallurgical Cabinet already includes specimens illustrating the various processes for obtaining the more common metals.

The Zoological Cabinet includes the Werner collection of nearly all the types of American birds with their nests and eggs, and the Packer collection of recent shells.

The Geological Cabinet numbers over ten thousand specimens and includes the Palæontological, Mineralogical, Petrographic and Economic collections. The former contains good specimens of nearly all the common genera. The Mineralogical division includes the Keim and Rœpper collections—the latter being especially complete and valuable from a crystallographic stand-point. The Petrographic division numbers several thousand specimens and besides including numerous varieties of nearly all the rocks of the globe, contains a duplicate set from the collection of the Second Geological Survey of this State. The Economic division was formed and donated by Dr. James P. Kimball, Director of the Mint, and formerly Professor of Economic Geology.

The Cummings Archæological Cabinet numbers three thousand specimens and includes Dr. Stubbs' Collection of Indian relics, weapons, and utensils.

THE ENGINEERING SOCIETY.

This society was organized in 1873, and admits, by election, students in the Junior and Senior Classes. Its meetings are held fortnightly. At these, papers relating to engineering subjects are read and discussed. It issues quarterly "The Journal of the Engineering Society" to which the members and others contribute.

THE MINING CLUB.

This was organized in 1883 and takes from the Junior, Senior, and Post Senior Classes, those members of the Mining School who excel in their studies or in practical experience in the subjects of the course.

THE ELECTRICAL ENGINEERING SOCIETY

was organized in November, 1887, by students in the Advanced Course in Electricity. Its object is to supplement the regular work of the department by the study and discussion of electrical subjects.

THE AGORA

is a Literary Society which meets semi-monthly—only students in the Course of General Literature are eligible to membership.

THE ATHENÆUM.

is also a Literary Society whose active membership is confined to the Sophomore Class. The meetings are held weekly.

FOUNDER'S DAY

On the second Thursday of October of each year Commemorative Exercises are held in honor of the Founder of the University.

On Thursday, October 13, 1887, the Ninth Founder's Day was celebrated. The Memorial Church was consecrated. The Bishop of Central Pennsylvania was the Consecrator, and the Bishop of New York was the preacher.

WASHINGTON'S BIRTHDAY.

This day is observed as a holiday.

On Tuesday, February 22, 1887, exercises were held in the Chapel. "An Essay on Washington as a Chief Mover in Federal Government" was read by Prof. Wm. A. Lamberton, and orations were delivered by Messrs. Domenech, Rau, Baldwin, Dravo, and Wiseman of the Junior Class.

UNIVERSITY SERMON.

This sermon is preached on the Sunday before University Day.

The Rt. Rev. Nelson S. Rulison, D.D., Assistant Bishop of Central Pennsylvania, was the preacher on Sunday, June 19, 1887, in the Memorial Church.

THESES.

Theses on the following subjects were prepared by the graduating class of 1887.

"A Theoretical and Practical Investigation of Railroad Rail-Joints."

ALEXANDER BONNOT.

"An Examination of the Zinc Blende from Friedensville, Pa."

CHARLES AUSTIN BUCK.

"Design of a Boiler for a Passenger Locomotive."

JULIAN CARTER BUCKNER.

"Plan and Estimate for a Water Supply for the Lehigh University."

BENJAMIN AMOS CUNNINGHAM.

"Comparison of Two Types of Steam Fire-Engines."

EUGENE DIVEN.

"The Life and Work of Socrates.

ALFRED DOOLITTLE.

"Influence of Mohammedanism on European Civilization."

MILTON HENRY FEHNEL.

"The Politics of Aristotle."

HARVEY SHEAFE FISHER.

"Ruskin on the Labor Question."

KENNETH FRAZIER.

"Steam Heating."

HENRY STEVENS HAINES, JR.

"The Three-Point Problem and its Application to the Finding of a Lost Station."

JOHN BENJAMIN FRANKLIN HITTELL.

"Friction."

JOHN MYERS HOWARD.

"Design of Pumping Engines for the City of Scranton."

WILLIAM FREDERICK KIESEL, JR.

"Discussion of the Errors in Precise Leveling."

JAMES WESSON KITTRELL.

"Discussion of the Precision of the Sægmüller Solar Attachment."

JOHN WALTER LADOO.

"Design of a Direct-Acting Steam Pump."

SAMUEL DAVIS LANGDON.

"The Drainage of the Borough of Bethlehem, with a Plan for the Improvement of the Streets."

FREDERICK BOWMAN LANGSTON, JR.

"The Equal and Righteous Administration of Justice."

GARRETT BRODHEAD LINDERMAN, JR.

"Review of the New Sewage System of the City of Chicago."

WILLIAM ANTHONY LYDON.

"Design of a Roof Truss of 100 Feet Span."

HARRY SMULLER MEILY.

"Design and Estimate of Cost for an Impounding Reservoir on Mill Run, near Altoona, Pa."

JAMES ALEXANDER MORROW.

"The Fireless Locomotive."

GEORGE FRANCIS PETTINOS.

"Plan and Estimate for a Suburban Railroad for Washington, D. C."

ROBERT HENRY PHILLIPS.

"Design and Estimate for a Cable Railway for Bethlehem."

CHARLES POPE POLLAK.

"An Investigation of the Easton and South Easton Suspension Foot-Bridge."

MASON DELANO PRATT.

"An Experimental Investigation of the Stiffening Girders of Suspension Bridges."

EVAN TURNER REISLER.

"The Practical Determination of an Azimuth."

GEORGE THOMAS RICHARDS.

"Design of a Machine for Binding Books."

JOHN WARWICK SCULL.

"On the Solubility of the Oxides of the Common Metals in Water Glass."

FRANK STUART SMITH.

"The Flow of Water over Wiers, with a Discussion of the Experiments made by the Class of 1887 on the Wier in the Hydraulic Laboratory of Lehigh University."

ELMER ELLIS SNYDER.

"The Geology of the Salem Coal Basin, Shickshinny, Pa.

EDWIN STANTON STACKHOUSE.

"Discussion of Recent Experiments on Friction."

OTWAY OWEN TERRELL.

"The Preparation of Anthracite Coal, with a Review of the Deringer Breaker."

PRIESTLEY TOULMIN.

"Blow Holes in Bessemer Steel Castings."

AUGUST JULIUS WIECHARDT.

"Review of the Water Supply of Allentown, Pa.

NISSLEY JOSEPH WITMER.

"Capital Punishment."

WADE HAMPTON WOODS.

"Design of a Boring Machine for Large Cylinders."

GEORGE FREDERIC YOST.

"The Early Institutional History of Virginia and Massachusetts."

CHARLES FREDERIC ZIMMELE.

THE ADDRESS BEFORE THE ALUMNI

was delivered on the evening of Alumni Day, June 22, 1887, in the Chapel of the University, by Francis A. Walker, Ph.D., LL.D., President, Massachusetts Institute of Technology.

UNIVERSITY DAY.

This day is the last of the academic year and falls in 1888 on the fourth Thursday in June. On this day orations are delivered by members of the Graduating Class, and Degrees are conferred.

EXERCISES ON JUNE 23, 1887.

Reading of Scriptures and Prayer by the Rt. Rev. A. M. de Wolfe Howe, D.D., LL.D., Bishop of the Diocese.

Salutatory Oration.—"The Dark Continent."

HARRY HARKNESS STOEK.

Oration.—"The Age of Engineering."

ROBERT HENRY PHILLIPS.

Oration.—"Love of Country."

CHARLES FREDERIC ZIMMELE.

Oration.—"The Labor Problem."

JOHN MYERS HOWARD.

Oration.—"Man's Inhumanity to Man."

HARVEY SHEAFE FISHER.

Oration, with the Valedictory Addresses.—"Civilized and Uncivilized.

MILTON HENRY FEHNEL.

Award of the Wilbur Scholarship to
JOHN LOCKETT
of Glengoffe, Jamaica, first in rank in the Sophomore Class, with honorable mention of
SAMUEL ERWIN BERGER
of Richland Centre, to whom was awarded the Wilbur Prize.

Award of Certificates for the Advanced Course in Electricity.

The following degrees were conferred:

B.A.

ALFRED DOOLITTLE,
HARVEY SHEAFE FISHER,
KENNETH FRAZIER.

B.Ph.

CHARLES FREDERIC ZIMMELE,
GARRETT BRODHEAD LINDERMAN.

B.S.

MILTON HENRY FEHNEL,
WADE HAMPTON WOODS.

C.E.

ALEXANDER BONNOT,
ROBERT HENRY PHILLIPS,
BENJAMIN AMOS CUNNINGHAM,
CHARLES POPE POLLAK,
JOHN BENJAMIN FRANKLIN HITTEL,
MASON DELANO PRATT,
JAMES WESSON KITTRELL,
EVAN TURNER REISLER,
FREDERICK BOWMAN LANGSTON,
GEORGE THOMAS RICHARDS,
JOHN WALTER LADOO,
ELMER ELLIS SNYDER,
HARRY SMULLER MEILY,
NISSLEY JOSEPH WITMER,
JAMES ALEXANDER MORROW,

M.E.

JULIAN CARTER BUCKNER,
SAMUEL DAVIS LANGDON,
EUGENE DIVEN,
GEORGE FRANCIS PETTINOS,
HENRY STEVENS HAINES, JR.,
JOHN WARWICK SCULL,
JOHN MYERS HOWARD,
OTWAY OWEN TERRELL,
WILLIAM FREDERICK KIESEL, JR.
AUGUST JULIUS WIECHARDT,
GEORGE FREDERIC YOST.

B.S.

ROBERT WEBB BARRELL,
EDWARD POWER VAN KIRK.

B.S.

(In Mining and Metallurgy.)

CHARLES COLCOCK JONES,
HARRY HARKNESS STOEK,
HENRY BENJAMIN CHARLES NITZE,
HENRY AUGUST JULIUS WILKENS,
RUFUS KING POLK,
FRANK WILLIAMS.

A.C.

CHARLES AUSTIN BUCK,
FRANK STUART SMITH.

E.M.

WILLIAM ANTHONY LYDON, B.M.,
EDWIN STANTON STACKHOUSE, B.M.,
PRIESTLEY TOULMIN, B.M.

The Benediction was then pronounced by the Bishop.

THE WILBUR SCHOLARSHIP.

This Scholarship was founded in 1872 by E. P. Wilbur, Esq., of South Bethlehem, and is the sum of $200 awarded annually to the student in the Sophomore Class having the best record.

THE ALUMNI SCHOLARSHIP.

The Alumni Association of the University has established a Scholarship of the value of $250 per annum, subject to the following conditions:

1. That the Scholarship shall only be awarded to a student really in need of it.

2. That the Scholarship shall not apply to the first year of any student's course; he must without this aid have gone through one year, and must be prepared to start the second year free from all conditions.

3. That the Scholarship shall not be continued to a student who shall at any time during his course carry any condition over eight weeks beyond the date of the examination in which he failed.

Subject only to the above conditions the disposal of the fund shall until otherwise directed be in the hands of the President of the University.

WILBUR PRIZE.

By the generosity of E. P. Wilbur, Esq., a fund has been established yielding an annual income of $100, for distribution in prizes as the Faculty shall determine.

ALUMNI PRIZES FOR ORATORY.

The "Alumni Association of the Lehigh University" has established an Annual Sum of Fifty Dollars, to be distributed as prizes for excellence in Oratory, subject to the following

REGULATIONS.

1. The Contest shall be held on the 22d day of February, or on the day designated by the University to commemorate the birthday of Washington.

2. There shall be a first prize of $25, a second of $15, and a third of $10.

3. To entitle one to be a competitor he must be a member of the Junior Class, taking a regular course.

4. Subjects for the oration shall be announced at the beginning of the first Term of every year and upon one of these, each competitor shall write an oration not to exceed eight minutes in delivery.

5. Each oration shall bear upon its first page a fictitious name or motto, and shall be accompanied by a sealed envelope, which shall be superscribed with the same name or motto, and an address by which it may be reclaimed. The envelope shall contain the real name and address of the writer, with the declaration that the oration is his own original work. The examiner, having adopted a standard of excellence, may reject any or all of the orations presented which do not attain to this standard; of such as do —should they be sufficient in number—the best six shall be chosen, and their envelopes opened. The others shall be retained to the address given with their envelopes unopened.

6. The Executive Committee of the Alumni Association, or a committee of not fewer than three to be appointed by them, shall hear the competitors, whose oration shall have been approved, and the awards shall be made by a majority of these Judges.

7. In awarding the prizes the judges shall consider both the literary merits and the delivery of each oration.

8. These rules are subject to amendment by the Faculty.

At the last contest, the First Prize was awarded to

ALBERT GEORGE RAU,

the Second, to

GEORGE READE BALDWIN,

and the Third, to

EDWARD BENJAMIN WISEMAN.

The next contest will take place February 22, 1888.

ENTRANCE EXAMINATION PAPERS.

Used at the Examination in 1887.

[Requests for other examination papers than those herein printed can not be granted.]

I.—ENGLISH GRAMMAR.

1. State the different ways of forming the plural of nouns, with examples.
2. Specify some nouns that have plural forms of different meaning.
3. Decline some compound personal pronoun.
4. How are tenses formed?
5. Give examples of correlative conjunctions.
6. Why can not an adjective be the subject of a sentence.
7. What is essential to a complete sentence?
8. In what grammatical relation do interjections stand to the rest of the sentence?
9. Write down the plurals of sheaf, chimney, duty, echo, dray, army, loaf, grove, stuff, staff, scarf, speech, pony, hoof, box, tooth, colloquy, thief, goose, deer, brother.
10. In spelling, what does a double consonant usually show?
11. Supply relative pronouns in these sentences:—Which was the road you took? He is not the man I expected. Have you received the money I sent you? Be reconciled with the man you offended.
12. What is meant by adverbs modifying the meaning of words?
13. What is a reflective pronoun, and how used?
14. Give examples of ordinal numerals.
15. Write down a sentence in which a phrase stands as subject of the verb.
16. How can the meaning of the possessive case be otherwise expressed?

17. Parse the sentence:—"Death to man in misery is sleep?"

18. Analyze the sentence:—"I had a dream, which was not all a dream."

19. Express the sense of the following by means of the passive voice of the same verbs:—(1) He hates lying. (2) That surprised me. (3) I had not expected this.

20. Parse *that* in the following sentences:—(1) Look at that star. He does that, that he may vex me. (3) That is certain. (4) He is the very man that I want.

II.—GEOGRAPHY.

1. Bound the State in which you live.

2. In what States or Territories are Memphis, Toledo, Milwaukee, Vergennes, and Eastport?

3. Locate the following rivers: Red, Dan, Penobscot, Wabash, and Rock.

4. Name and locate the capitals of Maine, Western Virginia, Nebraska, Mississippi, and Nevada.

5. Locate Sierra Nevada, Lake Itasca, Blue Ridge, Saut Ste. Marie, and Green Bay.

6. Locate Moscow, Riga, Toulon, Nice, and Aukland.

7. Give the principal city in Bulgaria, Tasmania, Saxony, Belgium, and Iceland.

8. Locate the Niger, Don, Rhone, Volga, and Shannon.

9. Locate the Balkan Mountains, Island of Trinidad, Sea of Marmora, Lake of Geneva, and Bay of Biscay.

10. Through what waters would you sail westward from Vancouver's Island to London by the most direct route?

III.—UNITED STATES HISTORY.

1. When and to whom was Georgia granted? Where was the first settlement made? Who were the settlers? When was slavery introduced? When did the war with Spain begin?

2. Name the four Acts passed by Parliament which the colonies could not help resisting?

3. Where was the Treaty of Alliance with France concluded? What was agreed on in the Treaty?

4. What were the leading events of John Adams' administration?

5. When and by whom was made the first serious attack on slavery? What name was given to the anti-slavery men? What was the effect on the South?

6. What was the subject of the Dred Scott Decision? And what did the Supreme Court decide?

7. What was the feeling of foreign nations at the outbreak of the war of Secession?

8. What was the Tenure of Office Act? Did President Johnson submit to it? Why was he impeached? By whom is the impeachment to be tried?

9. How are the Presidential Electors chosen, and how many Electors are chosen by each State?

10. Who retains the rights not given to the United States, or forbidden to the States.

IV.—ARITHMETIC.

1. (*a*) What is the highest common divisor of two or more quantities?

(*b*) Explain method of adding fractions.

(*c*) Having the difference of longitude between two places, how is the difference in time determined?

2. (*a*) What are the dimensions of a vessel which will hold one litre? How many quarts in a litre?

(*b*) Give number of pints in a quart; quarts in gallon? gallons in barrel; inches in link; links in chain; square chains in acre?

(*c*) What are assets and liabilities? When is stock said to be par?

3. Divide $[2\frac{1}{3} - \frac{7}{2} + 0.3]$ by $[19\frac{1}{4} - 7\frac{1}{0} + 1]$, reduce to decimal, and explain how position of decimal point is found.

4. Reduce 40.0973 kilometres to miles, rods, feet, and inches.

5. Having sold 30% of my land I have 17 acres remaining. How much had I at first?

6. Find interest, discount, and bank discount on $65.33 for 90 days at 4½%.

7. How much water must be mixed with wine worth $0.90 per gallon to make a mixture worth $0.60 per gallon?

V.—GEOMETRY.

1. (*a*) What is a polygon? a triangle? a regular polygon? a circle?

(*b*) What are the cases in which two triangles are equal? When are they similar?

(*c*) What is a tangent? a secant? a chord? a sector? a segment?

2. (*a*) When is a figure said to be symmetrical with respect to an axis? when with respect to a point?

(*b*) What is the measure of an inscribed angle? of an angle formed by a tangent and chord? of the angle formed by two secants?

(*c*) What is the value of the circumference of a circle in terms of the radius? of the area of a circle? the area of a sector?

3. The sum of all the angles of a polygon is equal to two right angles taken as many times less two as the polygon has sides.

4. Every point in the bisector of an angle is equally distant from the sides of the angle, and every point not in the bisector but within the angle is unequally distant from the sides.

5. In the same circle, or in equal circles, equal chords are equally distant from the center; and of two unequal chords, the less is at the greater distance from the center.

6. Upon a given straight line to describe a segment which shall contain a given angle.

7. If a straight line divides two sides of a triangle proportionally it is parallel to the third side.

8. To divide a given straight line in extreme and mean ratio.

9. The square described on the hypothenuse of a right angled triangle is equal to the sum of the squares described on the other two sides.

10. Given the perimeters of the regular inscribed and the similar circumscribed polygon, to compute the perimeters of the regular inscribed and circumscribed polygon of double the number of sides.

11. Of all triangles having the same base and equal areas, that which is isosceles has the minimum perimeter.

12. The sum of the face-angles of any convex polyedral angle is less than four right angles.

VI.—ALGEBRA.

1. (*a*) Give definitions of binomial; polynomial; monomial.

(*b*) Explain how one fraction is divided by another.

(*c*) What is the least common multiple of two or more numbers?

2. (*a*) What is the reciprocal of a quantity? What is the reciprocal of zero?

(*b*) What are involution and evolution?

(*c*) What is a radical? What is an imaginary quantity?

3. (*a*) What is the form to which every imaginary monomial may be reduced?

(*b*) What is the form to which every equation of the second degree may be reduced?

(*c*) Give formulæ for the nth term and for the sum of n terms of a geometrical progression.

4. Find the highest common divisor of

$$2x^3 + 5 - 8x + x^2 \quad \text{and} \quad 42x^2 + 30 - 72x.$$

5. Reduce the following to equivalent expressions having rational denominators:

$$\frac{x}{x + \sqrt{y}}; \qquad \frac{3 + 2\sqrt{2}}{\sqrt{5} - \sqrt{3}}; \qquad \frac{2}{\sqrt{5} + \sqrt{3} - \sqrt{2}}.$$

6. 875.021. Extract the square root, and give reasons for the various operations.

7. Solve the following equations:

$$\frac{9x+20}{36} = \frac{4x-12}{5x-4} + \frac{x}{4}; \qquad \sqrt{a+\sqrt{x}} + \sqrt{a-\sqrt{x}} = \sqrt{x}.$$

8. Divide a into two parts such that the sum of the quotients which are obtained by dividing one part by m and the other by n shall be equal to b.

9. Solve the following equations:

$$\left\{\begin{array}{l} ax + by = c \\ cx + az = b \\ bz + cy = a \end{array}\right\}; \qquad \left\{\begin{array}{l} x + y = 4 \\ \frac{1}{x} + \frac{1}{y} = 1 \end{array}\right\}.$$

10. $$\frac{a}{x} + \frac{\sqrt{a^2 - x^2}}{x} = \frac{x}{b}; \qquad x = \frac{12 + 8\sqrt{x}}{x - 5};$$

$$(x - a)(x + b)(x - \tfrac{1}{2}) = 0.$$

VII.—PHYSICS.

1. Define (*a*) Atom.
   (*b*) Molecule.
   (*c*) Erg.
   (*d*) Moment of a force.

2. Give the laws of
   (*a*) The lever.
   (*b*) The pendulum.
   (*c*) The pulley.

3. How long must a pendulum be to vibrate minutes?

4. Determine the specific gravity of granulated tin from the following data:

Weight of bottle filled with water at 60° F., 44.378 grammes.
" " tin, ... 9.431 "
" " bottle, tin and water, ... 52.515 "

5. What is a wave length?

6. If 4 lbs. of water at 60° C., 5 lbs. at 80° C., and 7 lbs. at 100° C. are mixed, what will be the resulting temperature?

7. What effect has distance on radiant heat?

8. Give the laws of refraction of light.

9. A lamp 30 ft. from a screen throws a shadow which is just equal to that made by a candle 5 ft. from the screen, what is the relative intensity of the two lights?

10. What is the best method of finding the best arrangement of the cells of a voltaic battery?

11. Describe a Dynamo. (Give its essential parts and their arrangement.)

12. What is the voltaic arc?

13. If the resistance of 130 yds. of copper wire $\frac{1}{16}$ in. in diameter is one ohm, what will be the resistance of 8,242 yds. of the same copper wire?

VIII.—LATIN.

I.—GRAMMAR.

1. Decline throughout, with the adjective *nullus*, the following nouns: *homo*, *dies*, *exsul*, *opus*, *princeps*. What other words are declined like *nullus?*

2. Write the genitive singular of *frigus*, *virus*, *nemus*, *limen;* and the nominative singular of *salutem*, *sitim*, *litore*, *silicis*, *vulnera*, *aethere*, *sulcis*.

3. Compare *fortis*, *difficilis*, *parvus*, *miser*. Form and compare the corresponding adverbs. From what adjectives are *prudenter*, *acriter*, and *parum* derived?

4. Distinguish *hic*, *iste* and *ille;* *quidam* and *quisquam*. When is the interrogative *quis* used, and when *qui?* Is there any difference between the inflection of *quis* (interrogative) and *quis* (indefinite)?

5. Discuss the meaning of each part of the word *aud-i-vi-m-us*.

6. What is a suffix, an affix, a radical, a stem, a root, an inflection? Explain the term "etymology."

7. Give the principal parts of the verbs from which the following forms are derived: *peteretur*, *aluut*, *praebent*, *perculsum*, *abiectum*, *canit*.

8. Write out in full the present tense of *volo*, *fio*, *fero*, *nolo*, *feror*, *prosum*. What is the deriviation of *malo*, *possum*, *nolo?*

9. How do you distinguish between verbs of various conjugations? What is the conjugation of *cantare*, *canere*,

struere, stare, aperire, cupere, tenere, elicere, cumbere, sancire, inveterascere, crepare, fugere, ardere, metere, plorare?

10. What is the gender of *manus, sermo, pes, compes, fraus, nubes, vannus, ratio?* Is this sentence correct: *Humus est humidus?* Give the reason for your answer.

II.—CAESAR.

Translate:

Ad haec Caesar, quae visum est, respondit; sed exitus fuit orationis: "Sibi nullam cum his amicitiam esse posse, si in Gallia remanerent; neque verum esse, qui suos fines tueri non potuerint, alienos occupare; neque ullos in Gallia vacare agros, qui dari, tantae praesertim multitudini, sine iniuria possint; sed licere, si velint, in Ubiorum finibus considere, quorum sint legati apud se et de Sueborum iniuriis querantur et a se auxilium petant; hoc se Ubiis imperaturum." - *B. G., IV.*, 8.

Change the words of Caesar to direct discourse.

III.—VIRGIL.

Translate:

D. Vis ergo inter nos, quid possit uterque, vicissim
Experiamur? Ego hanc vitulam—ne forte recuses,
Bis venit ad mulctram, binos alit ubere fetus—
Depono: tu dic, mecum quo pignore certes.
M. De grege non ausim quicquam deponere tecum:
Est mihi namque domi pater, est iniusta noverca:
Bisque die numerant ambo pecus, alter et haedos.
Verum, id quod multo tute ipse fatebere maius,
Insanire libet quoniam tibi, pocula ponam
Fagina, caelatum divini opus Alcimedontis:
Lenta quibus torno facili superaddita vitis
Diffusos hedera vestit pallente corymbos.

Ecl., III., 28–39.

1. In what sense does he use *vicissim?* 2. On what does *experiamur* depend? 3. Explain *ausim* and *domi.* 4. What is the grammatical antecedent of *quod* (line 8)? 5. Construction of *multo?* 6. Where did bucolic poetry originate?

Translate:

Ergo iter inceptum peragunt, fluvioque propinquant
Navita quos iam inde ut Stygia prospexit ab unda
Per tacitum nemus ire pedemque advertere ripae,
Sic prior aggreditur dictis atque increpat ultro:
"Quisquis es, armatus qui nostra ad flumina tendis,
"Fare age, quid venias, iam istinc et comprime gressum.
"Umbrarum his locus est, Somni Noctisque soporae;
"Corpora viva nefas Stygia vectare carina."

Aen., *VI.*, 334–391.

1. What is the object of *prospexit*?
2. With what is *iam istinc* to be joined?
3. Prosody:—*a*. Define the quantity of the final syllable of words more than one syllable, and the quantity of words of one syllable.
   b. Divide the last four lines of this passage into feet and mark the rhythmic accent.
   c. Give the reasons for your division.

IV.—CICERO.

Translate:

Quae cum ita sint, Catilina, dubitas, si emori aequo animo non potes, abire in aliquas terras et vitam istam, multis suppliciis iustis debitisque ereptam, fugae solitudinique mandare? "Refer" inquis "ad senatum;" id enim postulas, et, si hic ordo sibi placere decreverit te ire in exsilium, obtemperaturum te esse dicis. Non referam, id quod abhorret a meis moribus, et tamen faciam ut intelligas, quid hi de te sentiat. Egredere ex urbe, Catilina, libera rempublicam metu, in exsilium, si hanc vocem expectas, proficiscere. Quid est, Catilina? Ecquid attendis, ecquid animadvertis horum silentium? Patiuntur, tacet. Quid exspectas auctoritatem loquentium, quorum voluntatem tacitorum perspicis?—*Cat.* I., 8.

Translate:

Municipiis dispertiri iubet. Habere videtur ista res iniquitatem, si imperare velis; difficultatem, si rogare. Decernatur tamen, si placet. Ego enim suscipiam, et ut spero, reperiam, qui id, quod salutis omnium causa

statueritis, non putent esse suae dignitatis recusare. Adiungit gravem poenam municipiis, si quis eorum vincula ruperit; horribiles custodias circumdat et digna scelere hominum perditorum. Sancit ne quis eorum poenam, quos condemnat, aut per senatum aut per populum possit levare: eripit etiam spem, quae sola homines in miseriis consolari solet.—*Cat. IV.*, 4.

1. Whose opinion is here stated? 2. Who proposed the opposing opinion and what was it?

V.—SIGHT READING.

Translate (Cæsar, *B. G.*, *VI.*, 18):

Galli se omnes ab Dite patre prognatos praedicant, idque ab Druidibus proditum dicunt. Ob eam causam spatia omnis temporis non numero dierum, sed noctium finiunt; dies natales et mensium et annorum initia sic observant, ut noctem dies subsequatur. In reliquis vitae institutis hoc fere ab reliquis differunt, quod suos liberos, nisi cum adoleverunt, ut munus militiae sustinere possint, palam ad se adire non patiuntur filiumque puerili aetate in publico in conspectu patris adsistere turpe dicunt.

Translate (Cicero, *Epist.*, *XIII.*, 28):

Hegeseratus Larissaeus magnis meis beneficiis ornatus in consulatu meo memor et gratus fuit, meque postea diligentissime coluit. Eum tibi magno opere commendo ut et hospitem meum et familiarem et gratum hominem et virum bonum et principem civitatis suae et tua necessitudine dignissimum. Pergratum mihi feceris, si dederis operam ut is intelligat hanc meam commendationem magnum apud te pondus habuisse.

VI.—COMPOSITION.

1. Caesar moves his camp, and in about fifteen days arrives at the boundaries of the Belgae. 2. I have lived in Rome, Carthage, Athens, Naples and Corinth: and have now been three years at home in Gaul. 3. I sent a man to Caesar, to tell him this. 4. When you come, I shall go away (*abeo*). 5. Cicero was six years older than Caesar. 6. This book will be of great value to us. 7. He said that

this plan would be useful to all the states. 8. Let us ask them their opinion in regard to this calamity. 9. The Germans were not ashamed of their valor. 10. Many states sent embassadors to Rome to establish peace and friendship with the Roman people.

VII.—HISTORY.

1. Relate the traditions concerning the origin of Rome.
2. Describe the reign of Tarquinius Superbus.
3. Describe the causes and effects of the first secession.
4. Describe the conspiracy of Catiline.
5. Describe the decisive battles of Pharsalia, Philippi, and Actium.

IX.—GREEK.

Οἱ μεν δὴ στρατηγοὶ οὑτω ληφθέντες ἀνήχθησαν ὡς βασιλέα καὶ ἀποτμηθέντες τὰς κεφαλὰς ἐτελεύτησαν· εἷς μὲν αὐτῶν Κλέαρχος ὁμολογουμένως ἐκ πάντων τῶν ἐμπείρως αὐτοῦ ἐχόντων δόξας γενέσθαι ἀνὴρ καὶ πολεμικὸς καὶ φιλοπόλεμος ἐσχάτως. Καὶ γὰρ δὴ, ἑως μὲν πόλεμος ἦν τοῖς Δακεδαιμονίοις πρὸς τοὺς Ἀθηναίους παρέμενεν· ἐπεὶ δὲ εἰρήνη ἐγένετο, πείσας τὴν ἑαυτοῦ πόλιν ὡς οἱ Θρᾷκες ἀδικοῦσι τοὺς Ἕλληνας καὶ διαπραξάμενος ὡς ἐδύνατο παρὰ τῶν Ἐφόρων ἐξέπλει ὡς πολεμήσων τοῖς ὑπὲρ Χερρονήσου καὶ Περίνθου Θρᾳξίν. Ἐπεὶ δὲ μεταγνόντες πως οἱ Ἔφοροι, ἤδη ἔξω ὄντος αὐτοῦ, ἀποστρέφειν αὐτὸν ἐπειρῶντο ἐξ Ἰσθμοῦ, ἐνταῦθα οὐκέτι πείθεται ἀλλ' ᾠχετο πλέων εἰς Ἑλλήσποντον. Ἐκ τούτου καὶ ἐθανατώθη ὑπὸ τῶν ἐν τῇ Σπάρτῃ τελῶν ὡς ἀπειθῶν. Ἤδη δὲ φυγὰς ὢν ἐρχεται πρὸς Κῦρον. καὶ ὁποίοις μὲν λόγοις ἔπεισε Κῦρον ἄλλῃ γέγραπται· δίδωσι δὲ αὐτῷ Κῦρος μυρίους δαρεικούς· ὁ δὲ λαβὼν οὐκ ἐπὶ ῥᾳθυμίαν ἐτράπετο ἀλλ' ἀπὸ τούτων τῶν χρημάτων συλλέξας στράτευμα ἐπολέμει τοῖς Θρᾳξί, καὶ μάχῃ τε ἐνίκησε καὶ ἀπὸ τούτου δὴ ἐφερε καὶ ἦγεν αὐτούς· καὶ πολεμῶν διεγένετο, μέχρι Κῦρος ἐδεήθη τοῦ στρατεύματος· τότε δὴ ἀπῆλθεν ὡς ξὺν ἐκείνῳ αὖ πολεμήσων.

Decline : *Οἱ, στρατηγοί, ληφθέντες, κεφαλάς, αὐτοῦ, ἀνήρ, Ἕλληνας, ὄντος, τελῶν, τούτων, πάντων, πόλιν, στράτευμα, συλλέξας.*

Compare : *πολεμικός, πρῶτος, ὑστατος, σαφής, ταχίς, ἡδίς, εὖ, καλός, κακός.*

Give the principal parts of : *ληφθέντες, ἐτελεύτησαν, παρέμενεν, πείσας, ἐδύνατο μεταγνόντες, ἔρχεται, γέγραπται, ἐχόντων.*

Give the following tenses in full : pres. ind. act. of *ληφθέν-*

τες, also its aor. subj. act. ; aor. opt. pass. of ἀποτιμηθέντες; pres. subj. and impf. ind. of ἦν; aor. subj. mid. of διαπραξάμενος; fut. opt. of ἐδίνατο.

Where is ληφθέντες found? How do you recognize this tense? What other words in the first sentence are in the same tense? What part of speech is ὡς in ὡς βασιλέα, and what limitation is there to this use of ὡς? Parse τὰς κεφαλάς. τῶν ἐμπείρως αὐτοῦ ἐχόντων; what is the construction of αὐτοῦ? Where is γενέσθαι found, and what is its construction? What part of speech is ἐσχάτως? What case is τοῖς Λακεδαιμονίοις, and why is it in that case? What cases does πρός govern? What tense is παρέμενεν? From what verb is it? Why is the second syllable ε? Why is the ν at the end? What tense is ἐγενετο? From what verb is it? What sort of a clause is ὡς οἱ Θρᾷκες ἀδικοῦσι τοὺς Ἕλληνας? What voice is διαπραξάμενος? What is the force of a middle voice? What cases does παρά govern? Parse ἐξέπλει. What is the force of the participle πολεμήσων? Parse Θρᾴξίν. Where is ἐπειρῶντο found? What is the uncontracted form? Parse ἐθανατώθη. How do you express the agent with a verb in the passive voice? ὁποίοις λόγοις ἔπεισε Κῦρον: what is the case of λόγοις, and what does the case denote? What tense is ἐτράπετο? What is it from? Give the uncontracted form of ἐπολέμει. What is the force of ἀπό in ἀπὸ τούτων τῶν χρημάτων συλλέξας στράτευμα? Where is ἀπῆλθεν found? What is its present? Why is the second vowel η?

HOMER.

Τὸν δ' Ἑλένη μύθοισιν ἀμείβετο, δῖα γυναικῶν.
αἰδοῖός τέ μοί ἐσσι, φίλε ἑκυρέ, δεινός τε·
ὡς ὄφελεν θάνατός μοι ἀδεῖν κακός, ὁππότε δεῦρο
υἱεῖ σῷ ἑπόμην, θάλαμον γνωτούς τε λιποῦσα
παῖδά τε τηλυγέτην καὶ ὁμηλικίην ἐρατεινήν.
ἀλλὰ τά γ' οὐκ ἐγένοντο· τὸ καὶ κλαίουσα τέτηκα.
τοῦτο δέ τοι ἐρέω, ὃ μ' ἀνείρεαι ἠδὲ μεταλλᾷς.
οὗτός γ' Ἀτρεΐδης, εὐρὺ κρείων Ἀγαμέμνων,
ἀμφότερον, βασιλεύς τ' ἀγαθὸς κρατερός τ' αἰχμητής·
δαὴρ αὖτ' ἐμὸς ἔσκε κυνώπιδος, εἴ ποτ' ἔην γε.
ὣς φατο, τὸν δ' ὁ γέρων ἠγάσσατο· φώνησέν τε·

ὦ μάκαρ Ἀτρεΐδη, μοιρηγενές, ὀλβιόδαιμον,
ἦ ῥά νύ τοι πολλοὶ δεδμήατο κοῦροι Ἀχαιῶν.
ἤδη καὶ Φρυγίην εἰσήλυθον ἀμπελόεσσαν·
ἔνθα ἴδον πλείστους Φρύγας ἀνέρας, αἰολοπώλους,
λαοὺς Ὀτρῆος καὶ Μυγδόνος ἀντιθέοιο,
οἳ ῥα τότ' ἑστρατόωντο παρ' ὄχθας Σαγγαρίοιο·
καὶ γὰρ ἐγὼν ἐπίκουρος ἐὼν μετὰ τοῖσιν ἐλέχθην
ἤματι τῷ ὅτε τ' ἦλθον Ἀμαζόνες ἀντιάνειραι·
ἀλλ' οὐδ' οἱ τόσοι ἦσαν, ὅσοι ἑλίκωπες Ἀχαιοί.

Parse *τόν*. What case is *μύθοισιν*? Why in that case? What would it be in Attic? Parse *ἀμείβετο*. What Homeric peculiarity in its form? *αἰδοῖός τέ μοί ἐσσι*: why so accented? Where is *ἐσσί* found? Give the Attic form of it. What is *ἄδεῖν* from, and where is it found? What is the Attic form of *ὁππότε*? What is the nominative of *νιέϊ*, and why is it in the dative? Give the pres. and aor. of *ἐπόμην*. What is its Attic form? Decline *παῖδα*. What tense is *τέτηκα*, and what is it from? What is *ἀνείρεαι* from, and where is it found? Explain its termination. What part of speech is *ἀμφότερον*? What would *ἔσκε* be in Attic? What is the force of this termination, and to what tenses is it appended? What is *ἠγάσσατο* from? Why is the *σ* doubled? Give the nominative of *ὀλβιόδαιμον*. What is *δεδμήατο* from? Explain the peculiarity of its termination. Give the Attic for *εἰσήλυθον*. What is *Φρυγίην*, and why is it in that case? Nominative of *ἀμπελόεσσαν*? Is *μετὰ τοῖσιν* an Attic construction? Parse *ἤματι*: what would be in Attic? Give the Homeric declension of *ἐγώ*. What is Homer's peculiarity in treatment of the augment?

SIGHT READING.

Ἡνίκα δ' ἦν ἀμφὶ μεσας νύκτας, παρῆν Σεύθης ἔχων τοὺς ἱππέας τεθωρακισμένους καὶ τοὺς πελταστὰς σὺν τοῖς ὁπλοις. Καὶ ἐπεὶ παρέδωκε τοὺς ἡγεμόνας, οἱ μὲν ὁπλῖται ἠγοῦντο, οἱ δὲ πελτασταὶ εἵποντο, οἱ δὲ ἱππεῖς ὠπισθοφυλάκουν. Ἐπει δ ἡμερα ἦν, ὁ Σευθης παρηλαυνεν εἰς το προσθεν και ἐπηνεσε τον Ἑλληνικον νομον.

Write the last sentence with the accents.

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* Deceased.

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[W] Hampton Woods, B.S., Post Graduate, Lehigh Unisity, South Bethlehem, Pa.
Charles F. Zimmele, B.Ph., Bethlehem, Pa.

The number of Graduates is 252, of whom there are 23 who have taken the Degree of B.A.; 7 of B.Ph.; 99 of C.E.; 51 of M.E.; 24 of E.M.; 25 of A.C.; 13 of B.M.; 8 of B.S.; 2 who have taken the two degrees of A.C. and E.M.; 1 who has taken both B.S. and C.E.; 5 who have taken B.M. and E.M.; 1 who has taken C.E. and E.M.; and 1 who has taken B.M., A.C., and E.M.

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